Zanja No. 3: Brick Culvert
Alameda St. between Temple and Aliso Streets
Los Angeles
Los Angeles County
California

HAER No. CA-50

PHOTOGRAPHS

WRITTEN AND HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

Historic American Engineering Record
National Park Service
Western Region
Department of the Interior
San Francisco, CA 94102

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HISTORIC AMERICAN ENGINEERING RECORD
ZANJA NO. 3: BRICK CULVERT HAER NO. CA-50

LOCATION: West of Alameda Street, between Aliso and Temple Streets, in Los Angeles, Los Angeles County, California
UTM: 11.385760.3768560
Quad: Los Angeles, CA

DATE OF CONSTRUCTION: Open ditch dug between 1825 and 1831. Brick culvert over ditch at Commercial Street built 1869. Wooden sewer connection built 1869, discontinued 1871. Clay sewer pipe laid in wood sewer and through culvert, 1881.

PRESENT OWNER: U.S. General Services Administration, San Francisco, CA

PRESENT USE: None. Abandoned and filled 1882-3.

SIGNIFICANCE: Zanja No. 3 represents a portion of the original Los Angeles water system. The zanjas, a series of ditches from the Los Angeles River, were begun immediately after the establishment of the pueblo in 1781, and provided the community with water for domestic use and irrigation. At its zenith in the early 1880s, the low service water system for the city consisted of the main ditch, called the Zanja Madre, and eight side ditches, including Zanja No. 3. When Commercial Street was opened from Los Angeles to Alameda Streets in 1869, the brick culvert was installed to carry traffic over Zanja No. 3, then an open ditch.

The significance of the brick culvert of Zanja No. 3 is three-fold: it survives basically intact, including modifications; its construction typifies that found in other brick culverts in the area; and most importantly, it provides a tangible link to a system that once fed the life-blood to a dry but highly productive agricultural region that later evolved into one of the nation's largest metropolitan areas.

PROJECT INFORMATION: The brick culvert of Zanja No. 3 was documented in September, 1986 by Louis Berger & Associates, Inc., East Orange, New Jersey, for the Federal Bureau of Prisons, under a

Memorandum of Agreement between the General Services Administration, the California State Historic Preservation Office, and the Advisory Council on Historic Preservation. The project team consisted of John A. Hotopp, Ph.D., Director; Paul Friedman, Historian; Michael Rodeffer, Archaeologist; Rob Tucher, Photographer; and John R. Bowie, A.I.A., Consulting Architect.

I. INTRODUCTION

The brick culvert over Zanja No. 3, lying beneath the former location of Commercial Street, Los Angeles, was discovered during an archaeological testing program conducted in July 1986. The culvert was more fully excavated in September 1986 as part of a program to mitigate its future destruction for the erection of a new Federal Center complex at this location. The full results of the archaeological investigation effort are presented in a report entitled Zanja No. 3: Commercial Street Culvert: Intensive Archaeological Investigations at the Proposed Federal Center Complex, Los Angeles, California prepared by Louis Berger & Associates, Inc. for the Federal Bureau of Prisons (1987). The descriptive and historical narratives presented below are adapted from that report.

II. DESCRIPTION

The brick culvert over Zanja No. 3 is located in downtown Los Angeles, California, toward the east side of a block defined by Aliso Street on the north, Alameda Street on the east, Temple Street on the south, and Los Angeles Street on the west. The block is currently occupied by the Federal Building, the facade of which extends nearly the full length of the block on Los Angeles Street. Behind this building, to the east, the remainder of the block consists of a paved parking lot. The block as it now exists represents the joining of two smaller blocks, the boundary between them having been a segment of Commercial Street extending from Los Angeles Street to Alameda Street. This segment, opened in 1869, was closed in association with construction of the Federal Building in 1962.

Zanja No. 3 was one element in a system of open irrigation ditches that until the late nineteenth century provided water for agricultural and domestic purposes to the City of Los Angeles. Dug between 1825 and 1831, Zanja No. 3 remained in service until 1882-1883, when that portion north of First Street (including the segment described here) was discontinued and the open ditch filled in. Excavations of portions of the zanja north and south of the culvert revealed that the zanja at these locations consisted of an open ditch approximately six feet wide at the base and 10-12 feet wide at the upper break of its sloping sides. The average depth of the base of the zanja is 5.6 feet below the modern ground surface. The 165-foot segment of the zanja represented by the excavations at each end has been found to have a gradient of 0.5 percent.

In 1869, a brick "bridge" or culvert was erected over that portion of Zanja No.3 crossing Commercial Street, so that traffic would not be impeded by the then-open ditch. The exposed section of this culvert extends 36.0 feet from its south portal to the north face of the excavation on an azimuth of 175.5 degrees (Photo CA-50-1). Standard exterior width along the culvert is 8.0 feet. At the north end, the top of the culvert lies 2.06 feet below the asphalt street surface at an elevation of 270.59 feet. The top of the south portal of the culvert has an elevation of 270.33 feet.

The vertical walls of the culvert were set in builders trenches cut into the gravelly sand substratum which underlies the immediate area. The bottom of the construction trenches extends ca. 2.0 feet below the base of the channel of Zanja No. 3. The side walls of the culvert were laid with an interior width of 5.0 feet. These walls vary in thickness along their length from ca. 1.08 feet (13 inches) to ca. 1.44 feet (17.25 inches). This variation apparently derives from the use of different bonding techniques and patterns from one wall to the other.

The base course of the brick walls was set at an elevation of 265.37 feet at the south portal which equates with a depth below the present street surface of about 7.25 feet. The side walls were laid to a height of ca. 3.0 feet (36.0 inches) where the construction of a one brick wide (0.69 feet/8.25 inches) arch was initiated (Photos CA-50-2,3,4,5). The arch was raised to an interior height of 1.29 feet (15.5 inches) above the springline. The base of the arch was strengthened by corbelling at and slightly below the level of the springline. The upper two courses were stepped one-half brick (ca. 0.33 feet/4.0 inches) beyond the exterior edges of the walls. The lower two corbel courses on the west wall of the portal probably are the remnants of an integral tail wall that was removed during construction of later structures articulating with the culvert at this point. The arch is pierced at two locations toward the south end of the culvert. One opening, roughly square, is filled with a large stone. In the other, a portion of terracotta pipe is inserted; this feature is interpreted as the remains of a drain through the north face of which water from the gutter of Commerical Street could be conveyed into the culvert (Photos CA-50-2,3).

The stratigraphic cut and fill sequence within the culvert (Photos CA-50-6,7) differs from that of the adjacent, downstream open ditch (Photo CA-50-14) of Zanja No. 3. Strata within the culvert tend to be finer in texture, somewhat darker in color, and exhibit less evidence of oxidation.

The cut and fill sequence of the ditch is believed to be related to a series of historical events and attendant depositional pro-

cesses. The zanja was originally constructed as an irrigation and public water facility. Alluvial stratigraphic units located north and south of the culvert are interpreted as deposits of this free-running irrigation facility. These deposits are characterized by fine and medium light colored sands, which are not found at the base of the deposits in the stratigraphic column recorded for the culvert. The construction of the culvert in 1869 is believed to have altered the base alluvial sands of the ditch in this area. The base sands in the culvert generally tend to be darker, filling what are thought to be remnants of the builders trenches and a few inches across the floor of the culvert. Although the sands in the builders trenches appeared to be waterlain, they may have been packed fill altered by downward percolation and lateral movement of water during the last century.

Over these culvert basal sands is a massive deposit of fine textured silt to silty loam containing comparatively coarse material and artifactual debris. This deposit probably is associated with the 1869 installation of a wooden sewer (see below) which was likely to have been a major contributor of coarse materials in the culvert. The accumulation of debris in the open ditch through trash dumping supplemented by colluvial deposition probably blocked the culvert, resulting in diminished velocity, flow and the accumulation of considerable material. The active deposition of this final unit is believed to largely terminate with the closing of the wooden sewer in 1871.

In about 1883, the ditch was abandoned as a public facility and probably filled. Construction of the Los Angeles Farming and Milling Company's flour warehouse in ca. 1883 sealed the upper portion of the culvert at this time. Subsequently, deposition probably consisted principally of fine grained materials from gutter drains cut into the top of the culvert from Commercial Street. Sealed on the south and, presumably, on the north, the culvert acted as a cistern. The fill within the culvert likely remained constantly wet and was enriched with mineral fines, organics, and artifactual detritus from the gutters. The silts and clays percolated downward through the profiles, creating color and textural differences between the culvert fill and the ditch strata.

Several features are associated with the brick culvert at Commercial Street. These features represent two functional categories: public utility lines and architectural remains of buildings.

The earliest of these features is a wooden sewer, constructed in 1869, that intersects the brick culvert at a point centered 26.0 feet north of the south end of the culvert or ca. 5.0 feet north

of the center of Commercial Street (Photo CA-50-8). During the excavation, a section approximately 20 feet long was exposed, lying between ca. 2.7 and 5.9 feet below the present street level.

The wooden sewer is characterized by vertical sides and a flat floor. The floor is set inside the walls. The base of the walls and floor are flush. The sides and flooring are constructed from redwood 2 inch by 4 inch (0.17 by 0.33 feet) lumber in lengths up to 16.0 feet. The 2 x 4s were fastened face to face with 12d to 16d common cut nails. The 4 inch thick walls were raised in like manner to a height of about 3.17 feet (38 inches). Depth from the top of the north side to the floor measured ca. 2.78 feet (33.625 inches). The flooring material, rather than being stacked vertically, was turned on edge and secured horizontally from wall to wall. Like the sides, the floor was 4 inches thick. The lumber employed in the construction of the walls and floor appeared to be coated with a tar-like substance, most probably employed as a sealant and waterproofing agent.

The opening in the culvert created to accommodate the sewer is 3.6 feet (43.5 inches) wide and is supported by a 0.33 feet^2 (4 in^2) lintel which rests on the top of the sewer's wooden sides (Photo CA-50-9). Brick buttresses were constructed to secure the lintel on the east and strengthen the ends of the wooden wall work as well as perhaps seal the joints between the culvert and sewer (Photo CA-50-13). Posts 0.33 feet^2 (4 in^2) were set at the ends of the buttress walls and fastened to the sewer woodwork with bolts. A second pair of exterior support posts was set on approximately 5.0 foot centers to the west and secured in the same fashion. This pattern was not repeated further west suggesting that the center had been increased.

Within this segment of the wooden sewer is a small non-architectural brick wall, one and one-half bricks (ca. 1.0 foot/ 12.0 inches) thick, set between ca. 6.0 and 7.0 feet from the lintel terminus of the sewer. The wall is laid in common bond from the floor to ca. 0.10 feet (1.2 inches) above the sides of the wooden sewer, a height of about 2.90 feet (34.8 inches). The top of the wall is covered with mortar exhibiting a center ridge which suggests that at least one additional course was at one time present (Photos CA-50-10,11).

The wooden sewer was ordered shut off only two years after it was installed, and the brick wall is believed to have been the closure that sealed off the sewer. Ten years later, in 1881, a new sewer line in Commercial Street was ordered installed by the City Council. Remains of this new utility are evidenced by a tile sewer line constructed from sections 0.83 feet (10.0 inches) out-

side diameter by ca. 2.5 feet (30 inches) long, lying on the floor of the wooden sewer and passing through an opening in the base of the 1871 closure wall (Photo CA-50-12). This tile sewer line lies ca. 4.8 to 5.6 feet below street level at a centerline elevation of 267.45 feet. East of the culvert, it emerges through an irregular opening cut in the brickwork, measuring approximately 1.3 feet wide by 2.0 feet high (16 inches by 24 inches). Presumably, the line was laid in a trench although no evidence of this was observed because the line was cut away during the excavation by the backhoe a short distance east of the culvert (Photo CA-50-4).

A wall, one and one-half bricks wide (ca. 1.0 foot or 12 inches), extended approximately 4.0 feet eastward from the face of the culvert, paralleling the tile sewer at a distance of about 3.1 feet center to center (Photo CA-50-4). This feature, which was mortared to but not toothed into the face of the culvert, may have functioned as a headwall that was constructed to protect the tile sewer as it emerged from the culvert.

Also piercing the brick culvert is a utility line, probably a gas main, constructed of iron pipe 0.3 feet (3.5 inches) in diameter. West of the culvert, the main was laid south of and roughly parallel to the south wall of the wooden sewer at distances varying from ca. 0.8 feet at its westernmost exposure to 1.3 feet at the point where the feature enters the west wall of the culvert (Photo CA-50-10). The gas main was installed through the culvert 1.0 foot below its crest and was laid in a trench to the east. The pipe emerged from the culvert on the east through a small opening, ca. 0.4 foot (5.0 inches) in diameter, cut through the brickwork. The gas main was buried at an average depth of 3.0 feet below street level.

A water main, laid in Commercial Street, crosses the brick culvert 11.0 feet south of the center of the street and 26.0 feet north of the culvert's south end. The main is constructed of 0.67 foot (8.0 inches) diameter (outside diameter) iron pipe in 8 foot long segments. The base of the pipe effectively rests on the surface of the culvert, employing it as a bearing or pier (Photos CA-50-1,5). The main dips both to the east and west of the culvert to lie between ca. 2.0 and 2.6 feet below street level. At its high point over the culvert, the main lies about 1.2 to 1.8 feet below the street surface. The date of this particular feature is not known, but it lies in the approximate location of a utility line illustrated on an 1883 Sanborn fire insurance map.

The final utility feature to intersect the brick culvert is a concrete slab that lies beneath the grade of the culvert on the west side (Photo CA-50-7). A 1.83 foot (22.0 inches) by 3.0 foot

(36.0 inches) section of this feature was uncovered, located bet-between 10.0 and 11.90 feet from the south portal. The slab exhibited a rough surface and smoothed, possibly formed, sides and was approximately 0.5 feet thick. This feature lay at the base of a ca. 1.5 feet wide, 6.3 feet deep intrusion that extended to the surface at street level. This intrusion was cut through the concrete pavement, subsequently filled, and capped with asphalt. This intrusive trench and associated concrete "footing" align with electrical utility lines on various construction plans. Since no electrical conduit was encountered, presumably it was recently removed, the trench refilled and sealed with asphalt.

Foundation remains of two buildings abut the brick culvert at its south end. The first is a remnant of a brick foundation, which extends east from the face of the culvert's east wall. This foundation is two brick wide or ca. 1.5 feet (18.0 inches) and laid in common bond. The base of this feature is laid at a depth of about 4.8 feet below the concrete floor of the parking area or 3.1 feet below street level at an elevation of 268.54 feet, a depth that equates with that of the springline of the culvert. This feature is believed to represent the remains of a single-story brick warehouse erected on Commercial Street prior to the end of 1883 by the Los Angeles Farming and Milling Company.

The second "architectural" feature is a segment of a concrete foundation that extends west from the southern end of the culvert and parallels Commercial Street. The feature is 1.5 feet (18 inches) wide at the surface and expands to a width of about 2.0 feet (24 inches) near its base, approximately 4.79 feet below the concrete floor of the parking area or 3.1 feet below street level. This concrete wall extends from the interior edge of the east wall of the culvert across the south face. The base of this foundation equates with the springline of the culvert and lies at an elevation of 268.54 feet. This wall abuts the segment of brick foundation mentioned above, and together they form a continuous wall along what was once the south edge of Commercial Street.

The concrete foundation has been tentatively identified as a structural element of the north wall of the Post Office parking facility erected at this location by 1941 because the concrete foundation extended to the present surface. The presence of the brick foundation adjoining the concrete wall suggests that the construction of the garage's north wall utilized structural elements of the nineteenth century building.

III. HISTORICAL NARRATIVE

Development of Early Los Angeles

Los Angeles was originally established in 1781 by the Spanish authorities in Mexico as one of two civilan pueblos in Alta California. In 1822 California was incorporated into the Republic of Mexico, after Mexico declared independence from Spain. The treaty of Guadalupe Hidalgo in 1848, ending the Mexican-American War, brought California into the United States of America.

The first people of Euro-American descent known to have seen the Los Angeles area were members of the Portola expedition of 1796, who camped on the banks of a stream which one of them, the Franciscan priest Juan Crespi, named the "Rio Porciuncula." In 1777, when the Spanish governor of California, Felipe de Neve, traveled overland to the new capital of the province at Monterey, he selected a site for the future pueblo of Los Angeles three leagues from the Mission San Gabriel, on the Rio Porciuncula, or Los Angeles River, near the Native American village of Yanga (Temple 1931; Bynum 1931).

El Pueblo de la Reina de Los Angeles (the town of the Queen of the Angels) was founded on September 4, 1781 by 44 colonists recruited in Sinola and Sonora. They had come in response to promises made by the Spanish government to provide each settler with a house lot, agricultural land, livestock, seeds, implements, and a cash subsidy. In return they were expected to sell the surplus produce of the pueblo to the military presidios established in California. Just five years after this, in 1786, Governor Pedro Fages commissioned Alferez Josef Dario Arguello of the Santa Barbara presidio to go to Los Angeles and give the settlers there formal possession of their lands (Bancroft 1884).

The initial Spanish settlers at Los Angeles laid out the pueblo according to instructions issued by Governor Neve. House lots were arranged around a central plaza, with the plots of agricultural land to the southeast, on the west bank of the Los Angeles River. It is not known exactly where the original plaza was located. In 1815 the pueblo was flooded, and new plaza was established around 1818 when work was begun on the present plaza church. The 1815 flood also produced an alteration in the course of the Los Angeles River, which from then until 1825 followed roughly what is now Alameda Street, only to move again in the latter year to its present course to the east of Alameda Street.

At first, Los Angeles grew and prospered as an agricultural village. A census of the pueblo in 1790 listed 141 residents,

2,980 head of large stock (cattle and horses), 438 head of small stock (sheep and goats), and a harvest of 4,500 fanegas (equal to 1-1/4 bushels each). The town had 29 adobe houses, a granary, barracks, and guard house (Caughey 1976). At the beginning of the nineteenth century Los Angeles has 70 families and 315 non-native inhabitants. By 1810 the pueblo was reported to be producing 3,000 to 4,000 fanegas of wheat and corn. As of 1820 the pueblo and surrounding ranchos supported 650 people, making it the second most populous community in California, with only the capital at Monterey, with a population of 700, being larger (Bancroft 1884).

In the period from 1822 to 1846 Los Angeles emerged as an urban center with the appearance of merchants, craftsmen, and professionals. Several factors contributed to this. In 1822 the plaza church was completed, providing a focus for the community, and many of the town's more prominent residents built their homes around the new plaza. Mexico's independence from Spain that same year created a favorable trading environment, and foreign merchant ships sailed into San Pedro harbor to exchange finished goods for agricultural products. The secularization of the missions in 1833 helped stimulate the local economy, as the mission lands were divided among private landowners. At this same time, the number of land grants for ranchos in southern California also increased (Nelson 1977). The pueblo became more independent, being granted the ability to self govern through a town council, or ayuntamiento, in 1822. By 1830 Los Angeles, with a population of 1,000, was the largest settlement in California. Symbolically, it was raised in status from pueblo to ciudad in 1835. That same year Los Angeles was named capital of the province, although the actual relocation of the government did not occur until 1845 (Guinn 1915; Fogelson 1967).

At the conclusion of the Mexican-American War in 1848 Los Angeles became an American city. In 1850 it was incorporated, and that same year the census for the city counted 274 households and 1,610 people living in Los Angeles (Newmark and Newmark 1929). During the 1850s the city experienced its first major boom, as the local economy benefited from the gold rush to California and the regional cattle ranches thrived. The plaza was still the center of the community. North of it stood a collection of adobe houses, known as Sonoratown, occupied by Mexicans and South Americans who came to California during the gold rush. Finding the established Californio families entrenched around the plaza, American newcomers located south of it. The business district extended from First Street to the plaza, principally along Spring and Los Angeles Streets. One narrow portion of Los Angeles Street

just southeast of the plaza, known as Calle de los Negros, or "Nigger Alley," became the center of the city's gambling houses and saloons, although it later evolved into the community's Chinatown. By 1860 the population of the city had swelled to 4,399 people (Guinn 1915; Newmark 1930; Nadeau 1948).

Floods in 1861 and 1862 were followed by drought in 1863 and 1864, and the era of the rancho kingdoms was brought to a close. This worked to actually increase emigration to Los Angeles, as the ranchos were broken up and subdivided into smaller tracts for individual farms and intensive agricultural development (Guinn 1915; Cleland 1941; Dumke 1944). With the decline of the cattle ranches, viticulture emerged as one of the strongest sectors of the local economy. A visitor in the 1870s noted the the principal industry in Los Angeles was the production of wine and brandy (Salvator 1929:97).

The growing of grapes and making of wine was one of the oldest activities in Los Angeles. In 1818 it was reported that the pueblo has 53,686 vines planted (Nelson 1977). Los Angeles in 1831 supposedly has 112 acres in vines. According to Benjamin Hayes, at the time of the American occupation of Los Angeles in 1846 there were 103 vineyards and gardens in the city (Wilson 1959). In 1854 A.F. Coronel estimated there were nearly 400,000 vines in Los Angeles County, producing 3,000,000 pounds of grapes (Cleland 1941). Four years later there were about one million vines counted in Los Angeles County. The principal wine manufactures in the Los Angeles area included B.D. Wilson, with 100,000 vines at his San Gabriel Valley ranch in 1862; Matthew Keller, with 61,000 vines on his 75 acres on the east side of Alameda Street north of Aliso Street; the Sainsevain brothers, with their El Aliso vineyards on the south side of Aliso Street just west of the Los Angeles River; William Wolfskill with 85,000 vines on his land on the east side of Alameda Street south of First Street in 1862; and Frohler, Kohler and Company, with a vineyard at the corner of Kohler and San Pedro Streets. In 1866 the Los Angeles Grape Growers and Wine Makers Society was formed, with B.D. Wilson as president and Mathew Keller as vice-president. There were 36 distilleries in Los Angeles County in 1867, of which 15 were located in the city of Los Angeles (Wilson 1959). This industry, and other forms of agriculture, were made not only possible but successful through a combination of climate, soils, and a carefully developed water supply, derived from the Los Angeles River and conveyed through a system of zanjas, or ditches, the origins of which lay in the earliest years of the community.

Development of the Zanja System

Even before Los Angeles was settled, the issue of supplying water to the future town was taken into consideration by the Spanish authorities. In his instructions for locating the village, issued from San Gabriel on August 25, 1781, Governor Neve ordered that "after selecting a spot for a dam and a ditch with a view of irrigating the largest possible area of land, a site for the pueblo was to be selected on high ground, in sight of the sowing lands, but at least 200 varas distant, near the river or main ditch" (Bancroft 1884).

One of the first actions taken by the founders of Los Angeles, after laying out the original plaza, was the construction of a water system for the community. In a letter to his superiors in Mexico City, on October 29, 1781, Governor Neve commented upon of the progress already made at Los Angeles, writing:

> The Zanja Madre, or main water ditch for diverting the water of the Porciuncula (Los Angeles River) for irrigating purposes, has already been constructed, and the settlers are still working on their houses. Also the corrals for the cattle and horses have been completed, but these animals have not yet been distributed, in order that the settlers with greater zeal and energy might devote their time to completing the pueblo. After the accomplishment of which tasks, they will start to cultivate their lands for the sowing of grain (Temple 1931).

One of the stipulations of the Spanish regulations for the establishment of Los Angeles was that the settlers would have communal use of water, and land for pasture and wood (Bancroft 1884). Thus, the Los Angeles River was considered the property of the entire community, and from the founding of the pueblo onward the town claimed all rights to the Los Angeles River. Individuals who dug private irrigation ditches from the river did so under the auspices and consent of the municipal authorities (Layne 1957). After California became part of the United States, the pueblo water rights of the city of Los Angeles for the collective use of the Los Angeles River were confirmed by the California State Legislature. In the act incorporating Los Angeles as a city government in 1850, as amended in 1852, it was expressly written "that the Common Council shall have power, and it is hereby made their duty, to pass ordinances for the proper distribution of

water for irrigating city lands." Another act of the State Legislature in 1854 clarified that "vested in the Mayor and Common Council of the said city the same power and control over the distribution of water for the purpose of irrigation or otherwise, among the vineyards, planting grounds, and lands within the limits, claimed by the ancient pueblo and ayuntamiento of Los Angeles" (Hall 1888).

This system, dating back to the earliest Spanish times, was expanded and became more elaborate as the city grew, until it reached its peak in the early 1880s. However, after the real estate boom of 1887-1888, when much of the agricultural land in Los Angeles was subdivided into housing tracts, the need for the irrigation system declined, and the zanjas were eventually abandoned around the turn of the century (Brooks 1938; Layne 1957).

Virtually no records exist to document the operation or administration of the zanja system during the Spanish period in Los Angeles history, from 1781 to 1822. For the Mexican period, from 1822 to 1848, there are some accounts in the City of Los Angeles Archives. In Mexican times the ayuntamiento, or town council, maintained a standing committee to manage the zanja system. Assisted by the secretary of the ayuntamiento, the committee on zanjas established the schedule for irrigation and supervised the operation of the zanja system. They also has the power to appoint a ditch tender, or zanjero. In March, 1836 the committee on zanjas reported that "the zanja must be put in better order, and to accomplish this it is necessary to widen, deepen and straighten the same." To improve the zanja system, the town council decided that "all owners of crops and orchards be compelled to contribute with their person or an Indian" to perform the needed work (City of Los Angeles, Archives, Vol. 1:116). In June, 1836 Rafael Guirado, a member of the committee on zanjas, reported complaints over the fact that Indians were bathing in the zanja. The council decided to build a separate water hole for the Indians to bathe in, away from the main ditch. However, Guirado found it nearly impossible to prevent local women from washing clothing in the zanja. To halt that practice the council issued an ordinance the following year prohibiting the washing of clothing in the public ditch (City of Los Angeles, Archives, Vol. 2:156-161,322).

During the early American period, in 1854, under the administration of Mayor Stephen Foster, the position of zanjero, or overseer of water, was formally recognized and included as an official position within the city government. The zanjero was appointed by the City Council, and given the responsibility for maintaining and repairing the zanjas, issuing permits for water

use, collecting fees, scheduling the distribution of water and enforcing the municipal regulations pertaining to the city ditches. Beginning in 1873 the zanjero was assisted during the summer by several deputies, each of whom managed a separate irrigation district. So important did the zanjero's position become that at one time he was paid a higher salary than the mayor. As in the Mexican period, the City Council appointed a committee to supervise the zanjero and direct the operation of the irrigation system. For a time this committee was known as the Board of Water Commissioners. Then, in 1872, the board was replaced by a Committee on Zanjas (Ostrom 1953; City of Los Angeles, City Council Minutes, Vol. 7:443).

In 1872 the City Council passed a series of regulations dealing with the water ditches. The duties of the water overseer were spelled out, the price of water was set, and irrigators were ordered to have floodgates properly constructed. The regulations stated that water from the city canals could only be used for irrigation and domestic purposes, and they prohibited damaging a zanja, or throwing filth into a water course (McPherson 1873).

All expenses for the maintenance and operation of the zanja system were financed by fees paid by water users and a special water tax that were combined by the City Council in a separate water fund. The water rates in 1872 were $1.50 a day and $1.00 a night. In 1888 the rates were $3.00 per head per day, $2.00 a half day, and $0.50 an hour. An irrigation head is normally considered to be one hundred miners inches, but in Los Angeles the actual volume delivered by a given ditch at a given time could not be accurately measured. The State Engineer estimated in 1888 that the heads flowing in the various low-service ditches ranged from 150 to 250 miners inches, or 1.5 to 2.5 head. The irrigating season typically lasted from March to October. The zanja system was never a profitable institution. From 1880 to 1885 expenses totaled $68,980.22, while receipts from water sales during that same five year period brought $68,527.98. The deficit was made up through taxation and bond issues (Hall 1888).

The zanjas, as originally constructed in Hispanic times, were simple gravity-flow open ditches, of uneven width, depth and grade, meant to serve the low-lying areas adjacent to the Los Angeles River. This system remained little changed into the 1870s. A visitor to Los Angeles in that decade observed:

> The water is brought down into the city from the point of diversion and distributed by ditches, or zanjas, for irrigation and domestic purposes. These vary in size

> but the majority are three feet broad and one foot deep. The water travels at a speed of five miles an hour. Every proprietor is entitled to let the water run for as many hours a week as justified by the amount of his holdings. The zanjas are in charge of an official called a zanjero who regulates the distribution of the waters and sees that the ditches are kept in order (Salvator 1929:54).

E.O.D. Ord's Plan De La Ciudad De Los Angeles of 1849 (Map 1) illustrated only the pueblo's main canal, known as the Zanja Madre, and two branch ditches. It was estimated that at the time of the Ord survey about 1,500 acres were irrigated in Los Angeles, almost equally divided into plots of corn, vineyards, gardens, and pasture land (Hall 1888). The low-service system on the west side of the Los Angeles River, as it was eventually developed, consisted of the Zanja Madre and seven branch ditches: zanjas 6-1, 1, 2, 3, 4, 5, and 8. Apparently, most of these irrigation canals were built in the early American period. For example, Zanja No. 6-1 was constructed in 1857 to supply water power for the Aliso Mill, built on the corner of Aliso and Lyons Street. Zanja No. 8 was also dug in the late 1850s, by O.W. Childs, under a contract with the City of Los Angeles (Newmark 1930; Workman 1936).

During the Spanish period, water was diverted from the Los Angeles River north of town by a crude brush and dirt toma, or dam, and conveyed to the pueblo by the Zanja Madre, which was an open ditch at the base of a bluff on the west side of the river. In 1854 a water wheel was built just west of modern North Broadway to lift the water into the zanja, which flowed southerly in an embanked channel to its division point with Zanja No. 6-1, at the intersection of Buena Vista and San Fernando Streets. The Zanja Madre continued south, making a drop of 18 feet at the locations of the old Eagle Mill, later known as Capital Mill, near the corner of San Fernando and College, where the water power was utilized, and ran along the west side of Alameda Street past the plaza, then east of Los Angeles Street to First Street. There it was divided into several of its main branch ditches. Zanja No. 6-1, from the place it split from the Zanja Madre, flowed closer to the Los Angeles River, east of Alameda Street, to First Street, where it fed Zanjas 1 and 2. The low-service district on the east side of the river was supplied by Zanja No. 7. The Map of the Irrigation System of Los Angeles (1907) (Map 2) illustrates how the low-service zanja system appeared in 1884, including annotations by the City of Los Angeles Engineering Bureau concerning later changes in the network.

It was said that water from the Zanja Madre was also employed to run machinery at W.H. Perry's cabinet shop on Main Street near the plaza. In 1871 the city's first ice plant was built on the northwest corner of Marchessault and Alameda Streets, on the east side of the plaza, and water from the zanja was used to provide power (Layne 1957). The privately owned Los Angeles Water Company, which obtained the city's domestic water supply franchise in 1868, also had its headquarters at this location, and utilized a drop of 1.36 feet in the Zanja Madre here (Costello and Wilcoxon 1978; Goldworthy 1879).

In 1861 a City Council committee recommended that a new water wheel, flume and ditch be built to improve the zanja system. Funds of $4,000 were raised by private subscription and the work was done by the firm of Perry and Woodsworth. Floods in 1862 wiped out the dam. Later that same year Jean Louis Sainsevain won a contract for $18,000 from the City of Los Angeles to rebuild the dam and flume (Brooks 1938; Layne 1957).

Additional improvements were made to the zanja system after 1877, when $115,000 in city bonds were authorized for that purpose. That year a new wooden pile dam was built on the river at Dayton Avenue to replace the former earth and brush dam at Broadway. The improvements also included constructing a 3,320 foot long tunnel for the Zanja Madre, running through the bluff west of the river, from the point of diversion south to the head of Zanja No. 6-1. Because of costly repairs, this tunnel was eventually abandoned, and the Zanja Madre returned to an open ditch (Hall 1888).

A city engineering drawing indicated that by 1879 the Zanja Madre was carried in a brick conduit from College Street as far as Macy Street and was a covered wooden flume from Macy south to First Street (Goldworthy 1879). By 1880 the brick conduit was extended to Requena Street (City of Los Angeles, Bureau of Engineering 1880a).

In 1884 floods once again damaged the zanja system. The City Council appointed a board of engineers to devise a plan for improving the irrigation network, and in 1885 $125,000 in expenditures were authorized. Most of this money was spent replacing some of the open ditches with cement pipes. Provisions were made so that the zanjas could admit storm waters from the streets, thus keeping them entirely separate from the city's sewers, which were in their early stage of development (Hall 1888).

The zanjas reached their zenith in the mid-1880s. In 1886 the system irrigated 6,897 acres inside the city limits, and an additional 4,239 acres outside the city. It was estimated in 1880 that of the lands irrigated by the zanjas, 29 percent were in

vineyards, 29 percent in citrus, 18 percent in deciduous fruit trees, 3 percent in alfalfa, and 21 percent in gardens. In 1888 it was calculated that the zanja system in Los Angeles totaled over 52 miles of irrigation canals, of which about 26 miles were open ditches, 3 miles were wooden flumes, 17 miles were cement conduits, and 6 miles were iron pipes (Hall 1888).

The zanja system could be divided into the low-service and high-service works. The low-service system was the expansion of the original zanja network on the floodplain and low terrace adjacent to the Los Angeles River. On the west side of the river was the Zanja Madre and the seven branch ditches previously mentioned. On the east side of the river was Zanja No. 7. The total low-service system included 120,255 feet of irrigation canals in 1888.

The high-service irrigation works were a later innovation, built to meet the needs of a growing Los Angeles during the early American period. This system served the plateau on the west side of the city through the formerly privately owned Los Angeles Canal and Reservoir network, while the plains of East Los Angeles above Arroyo Seco were supplied by the so-called East-side system. The Los Angeles Canal and Reservoir Company was formed in 1867, with surveyor George Hansen as president. The company bought the old Feliz ditch and water rights to the Feliz Rancho and conveyed water from the Los Angeles River to Reservoir No. 4 at Echo Park. From there Zanja No. 8-R, with its five branches, took water as far west as Hoover Street. This canal was also known as the woolen mill ditch, since it took water for power used by the old woolen mill built by the Barnard brothers in 1872 on Figueroa Street. The City of Los Angeles bought this system in 1878 (Layne 1957).

The East-side high-service system began from the main supply ditch of the Los Angeles Canal and Reservoir network, and carried water across the Los Angeles River to Boyle Heights by way of Zanja No. 9-E. This old ditch was eventually replaced by a cement pipeline which brought the water to Reservoir No. 5. From there water was distributed by Zanja No. 9-R. In 1888 the total high-service system had more than 124,000 feet of irrigation canals (Hall 1888).

At the same time that the City of Los Angeles was operating the zanja system, private companies were allowed to construct their own domestic water supply networks, as long as they obtained permission from the City Council. In Hispanic times domestic water was obtained solely from the Zanja Madre. Things had not markedly improved in the early American period, for when Harris Newmark (1930) came to Los Angeles in 1853 he found that the common means of obtaining household water was to purchase it from a private

water carrier. These carriers brought water, drawn from the zanja, through town in buckets on a horse drawn wagon. That same year Judge William G. Dryen proposed to the Los Angeles City Council that they grant him the franchise for distributing water to homes in town through a system of pipes. Three years later, in 1857, Dryden was awarded such a contract. The following year Dryden incorporated the Los Angeles Water Works Company, with capital of $10,000 and Patrick McFadden as a partner, to build his domestic water supply system. They planned to bring water from natural springs owned by Dryden, known as the Avila Springs, on San Fernando Street in the northern part of the city, to a brick reservoir erected in 1860 in the middle of the plaza. They were allowed to put a water wheel in the Zanja Madre to operate a pump to raise the water to the reservoir. From this tank water was to be conveyed in log pipes to homes of various private subscribers (Ostrom 1953; Layne 1957; Wilson 1959).

In 1863 the City of Los Angeles entered into a contract with Jean Luis Sainsevain for another domestic water supply system, actually in competition with Dryden. Sainsevain agreed to build a new dam on the Los Angeles River, with a flume connecting it to a reservoir he constructed at Buena Vista Street and Bishops Road. From there he was to lay pipes through the city. In 1865 David W. Alexander took over this contract, and the City of Los Angeles granted him a four year lease, with an option for an additional six years, to complete 1,500 feet of pipe and make the system operational. After meeting with difficulties, Alexander conveyed the lease back to Sainsevain, who took Damien Marchessault, a former mayor of Los Angeles, as a partner. They completed the dam, built a new water wheel, and put in a system of wooden pipes. Unfortunately, the pipes leaked, and so in 1867 Sainsevain and Marchessault, entered into another contract with the City, to replace the wooden pipes with 5,000 feet of iron ones. A flood in the winter of 1867-1868 wiped out their dam and water wheel, and Marchessault apparently distraught over this failure, committed suicide in the City Council chambers. Sainsevain then assigned the franchise to the partnership of Prudent Beaudry, John L. Griffin, and Solomon Lazard, who completed the contract (McPherson 1873; Newmark 1930; Ostrom 1953; Layne 1957).

Early in 1868 Beaudry, Griffin and Lazard offered to lease the city's domestic water franchise for 50 years. When this offer met with general public disapproval, they changed it to a 30 year lease, with the promise of improvements and an annual payment of $1,500 to the City of Los Angeles. Rival offers were made by Patrick McFadden and Juan Bernard, who had acquired Dryden's Los

Angeles Water Works Company, and John Jones. But when the City Council finally made its decision, in July, 1868, all motions from the floor were tabled, and the lease to Beaudry and his associates was pushed through. In September, 1868 the Beaudry consortium incorporated as the Los Angeles City Water Company, with J.L. Griffin as president, and $220,000 in capital (Wilson 1959; Newmark 1930; Nadeau 1948: Ostrom 1953).

In 1870 the City Council revoked its grant to Dryden's Los Angeles Water Works Company to operate a domestic water supply system and ordered the removal of the brick reservoir in the plaza. The Los Angeles City Water Company was asked to replace the water tank with a fountain. Since McFadden and Bernard, who had taken over Dryden's company, could not use the reservoir in the plaza, they petitioned to build a new reservoir on Fort Moore Hill. When this was denied by the City Council, the Los Angeles Water Works Company sold out to the Los Angeles City Water Company, and Bernard, in fact, became a director for the new company, along with W.H. Perry and S.H. Mott (McPherson 1873; City of Los Angeles, Archives, Vol. 6; Layne 1957; Ritchie 1963).

The Los Angeles City Water Company immediately began to make improvements in the domestic water supply system. They built a new reservoir at Buena Vista Street, and by 1871 had laid 7,730 feet of eight-inch cast iron pipe. By 1883 the company serviced 1,900 customers, out of a total city population of about 12,000 people. There was one 22-inch 12-gauge sheet iron trunk line from the Buena Vista reservoir to First and Main Street, and 11-inch sheet iron line from the Buena Vista reservoir to Bishops Road. East Los Angeles was supplied by one six-inch cement-lined sheet iron main. Boyle Heights was served by a six-inch pipe by way of Aliso Street. The Washington and Main Streets district was supplied by a four-inch cast iron main from Seventh Street and Main south to Washington Street. The rest of Los Angeles still depended on the city-owned and operated zanja system for water.

As shown by the fact that the City Council had let out separate contracts to both Dryden and Sainsevain, the right to supply Los Angeles with domestic water was not meant to be an exclusive privilege. At various times there were several companies supplying different parts of the city with water. However, in the course of its 30-year lease with the City, the Los Angeles City Water Company managed to swallow up its competition and obtain a monopoly for the water franchise in Los Angeles. In 1872 Prudent Beaudry, who dropped his association with the Los Angeles City Water Company, obtained title to the old Dryden springs at San Fernando and College Streets. He pumped water up to two reservoirs on Figueroa Street and used it to supply a housing tract he

subdivided on Bunker Hill. In 1886 the Citizens Water Company bought out Beaudry, and they, in turn, were acquired by the Los Angeles City Water Company in 1892. The same year, Henry Hazard and several associates incorporated the East Side Springs Water Company to supply water to Brooklyn Heights. The Los Angeles City Water Company purchased Hazard's works in 1891.

In 1897 the City Engineer made a survey of the Los Angeles City Water Company property, and recommended to the City Council that the city buy out the private water company at the conclusion of its lease. Negoiations between the City and the company followed. In 1899 a city election approved the issuance of bonds to pay for the acquisition of the domestic water works. A compromise with the Los Angeles City Water Company was hammered out in 1901, allowing the City of Los Angeles to acquire the company's assets for $2 million. In February, 1902 the city government took control of the water company. Most of the company's employees were retained and transfered to municipal civil service, and William Mulholand then became the superindentent of the city's entire water system.

At this time the zanja irrigation system, which had always been owned and operated by the City of Los Angeles, was merged with the domestic water supply system established by the formerly privately owned Los Angeles City Water Company. George Pessell, who has been appointed the City Zanjero in 1901, then became the Water Overseer for the newly acquired municipal water works. At first the water department was administered by the City-appointed Board of Water Commissioners. In 1911 the Department of Public Services was created within the city government, to oversee the Power Bureau and Water Bureau. This evolved into the modern City of Los Angeles Department of Water and Power in 1925 (Ostrom 1953; Layne 1957).

When the City of Los Angeles took over the domestic water company it consisted of six reservoirs, Buena Vista, Bellevue, Beaudry, Hazard, Angeleno and Highland; filtration galleries at Crystal Springs; two pumping plants, at Bueva Vista and Highland; and 337 miles of pipe supplying water to 23,180 water customers. The new municipal water department immediately began making improvements. New storage facilities were built at the Elysian reservoir site in 1903, the Solano reservoir in 1904, and the Ivanhoe reservoir in 1905. In 1903 the City bought the West Los Angeles Water Company, adding 26.65 miles of main to the system.

During the years 1902 and 1903 the supply from the Los Angeles River was so low that water had to be pumped from the Zanja Madre, which had previously been reserved for irrigation purposes

alone, into the domestic facilities. This proved to the city water department that the zanja system was not really essential, and could be abandoned in order to conserve water for the domestic works (Brooks 1938; Layne 1957).

In reality, the so-called "boom of the '80s" has spelled the end for the zanja system. In 1880 the population of Los Angeles was 33,881 people. Then in 1885 the Santa Fe Railroad was completed to Los Angeles, giving the city two transcontinental railroad connections. A fare war erupted between the Santa Fe and the Southern Pacific Railroads, with round trip tickets from Missouri selling for as little as $15, and tourist class one way even falling to $1 for a few days (Newmark 1930). This, combined with extensive advertising and promotion of the advantages of the region, led to a land rush to Southern California in the period from 1887 to 1889 (Dumke 1944). By 1890 there were 101,454 people living in Los Angeles. The mayor of Los Angeles, W.H. Workman, observed in 1887 that "the necessity of irrigation within the city limits does not now exist to any great extent as most of the vineyards or orchards have been subdivided and made into residential sites for our rapidly growing population" (Ostrom 1953:40). In 1888 Zanja No. 5 was closed, and the abandonment of the other irrigation canals followed in the next 15 years.

The city water department, realizing that its domestic supply system could not meet the needs of such a rapidly growing population, began looking beyond the Los Angeles River for water. In 1904 William Mulholand led a survey of the Owens Valley. The citizens of Los Angeles then passed a bond issue in 1905 to purchase water rights on the east slope of the Sierra Nevada and fund the construction of an aqueduct to bring Owens Valley water to the city. Work on the aqueduct began in 1908 and was finished in 1913.

By the time the Owens Valley project was completed, the zanja system in Los Angeles had been completely abandoned. William Mulholand, in his annual report of 1903 to the Board of Water Commissioners, commented that "the zanja system has made its usual poor showing for the year....It would certainly be the greatest folly to spend any more money in new construction on this system." By the end of 1904, the city water department had shut the zanjas down completely, because the system was no longer considered economical, the demand for irrigation water was steadily declining, and the supply from the Los Angeles River was needed for domestic purposes. In his report that year, Mulholand observed that, "the whole flow of the stream (Los Angeles River) is now devoted to domestic use, and the zanja system is abandoned." He added that this "caused a good deal of hardship

to many who had rich alfalfa fields and orchards within the city limits, but they patiently accepted the inevitable and relinquished what their predecessors had held for over a century" (Layne 1957).

The actual wooden flumes, brick and cement conduits, and iron pipes which had carried the waters of the zanjas did not, however, just disappear. Parts of the system have remained buried under the streets of Los Angeles since the 1880s. Many were converted to other uses. In the early American period it was not uncommon for the zanjas to be used both for irrigation and as public sewers. A lawsuit in 1871 ended this practice, as the City was enjoined from allowing a zanja originally built for irrigation to be turned into a public sewer (Kohler vs. Los Angeles 1871). The City Council solved this problem by building zanjas specifically for carrying sewage. For example, in 1872 Zanja No. 9 was created "with the express purpose of conveying all sewage matter" from First Street to Olive Street (City of Los Angeles, City Council Minutes, vol. 7:593). In the 1880s sewage, mixed with waste waters from the irrigation canals, was carried by special zanjas to the Cudahy and Nadeau ranches south of the city, where about 3,000 acres were irrigated with it. When this method of disposing of waste became objectionable to the general public for health reasons, the City of Los Angeles built its first outfall sewer to the ocean around 1902.

Improvements made on the zanjas after 1885 included allowing them to be used as storm drains, to admit flood waters from the streets, while keeping them separate from the city's embryonic sewer system. The first major underground storm drains in Los Angeles were constructed around the turn of the century, and some of the enclosed zanjas were then incorporated into that system. For example, the storm drain in College Street extending south from Alhambra Avenue to Wayne Street was originally Zanja No. 6-1 (Hall 1888; Ferguson 1972). The conversion of zanjas to storm drains sometimes caused problems. As a case in point, in 1907 the Zanja Madre, which by that date was being used as a storm drain between Aliso and Commercial Streets, became obstructed and flooded the basement of the old Cohn building on the north side of Commercial Street. The map accompanying the report to the Board of Public Works showed the Zanja Madre to be constructed of two rings of brick, 36 inches in diameter, at this location, with silt levels between 7 and 22 inches deep along it (Robinson 1907). As late as 1933 a city engineering drawing indicated that a 12-inch cement pipe storm drain running east in Commercial Street from Los Angeles Street connected with the 36-inch brick Zanja Madre (Jessup 1933).

Zanja No. 3

The earliest known depiction of Zanja No. 3 is that of Ord's Plan de La Ciudad de Los Angeles (Map 1), which clearly illustrated a ditch that branched off from the Zanja Madre and followed Alameda Street into the vineyards and orchards south of Aliso Street, which was property owned at that time by Alexander Bell, Nathaniel Pryor and Manuel Requena. The Kelleher map of 1875 (Map 3), which attempted to show what the Zanja Madre, side ditches, and old town of Los Angeles looked like around 1855, had this ditch diverging from the Zanja Madre at approximately the intersection of College and Alameda Streets and continuing south along the west side of Alameda Street across Aliso Street. However, the Kelleher map is not considered reliable and is known to have several errors. An almost indisputable map is the survey conducted by George Hansen on September 20, 1855 of the Garfias and Rimpau property between Olvera and Alameda Streets (Map 4), which clearly shows a branch zanja taking off in a southeasterly direction from the Zanja Madre behind the Avila adobe and continuing along the west side of Alameda. This is again clearly illustrated in the 1874 map of the plaza by Frank Lecouvreur, another very reliable surveyor (Map 5). Like Kelleher, Lecouvreur attempted to show land ownership circa 1855. The Zanja Madre was shown running in a southerly direction just below and to the east of the bluff, west of Alameda Street. Behind the Avila adobe it splits, with the branch ditch heading southeast and along the west side of Alameda Street. This ditch was illustrated on Ruxton's 1873 map of the plaza as continuing south along the west side of Alameda Street across Aliso Street. While this branch was not named on any of the early maps, it is known from other sources to be Zanja No. 3.

Both the 1869 and 1870 Lecouvreur maps (Maps 6, 7) indicated that Zanja No. 3 and the Zanja Madre were open ditches at that time. It is known from other sources that the Zanja Madre was converted into a brick conduit from Macy to Requena Streets around 1880 (Goldworthy 1879; City of Los Angeles, Bureau of Engineering 1880). John Jackson's 1881 map of Commercial Street (Map 8) showed that the Zanja Madre was a brick conduit but did not specify what Zanja No. 3 was carried in. Nor is this situation clarified by an 1883 city engineering drawing of Zanjas 3, 4, and 5 at First Street (Hansen 1883). Zanja No. 3 is shown crossing First Street just east of Vine Street (modern Central Avenue), but it is not clear what the zanja is made of. In the same drawing, Zanja No. 5 was labeled as a ditch, so perhaps this indicated that Zanja No. 3 was also a ditch at this point at that date, since they were illustrated in a similar manner. Hall in 1888 stated that Zanja No. 3 was an open ditch from First to Seventh Street (4,800 feet), a 22-inch cement pipe from Seventh

to Twelfth Streets (3,200 feet) and was an open ditch again from Twelfth Street to the southern limit of the city (4,750 feet). This does not, however, clarify what the zanja looked like between Aliso and First Streets in the early 1880s.

Zanja No. 3 was probably constructed during the Mexican period to serve the vineyards and orchards of Jean Luis Vignes, Nathaniel Pryor, and Manuel Requena, who owned the land south of Aliso Street between Los Angeles and Alameda Streets. From First Street south the ditch ran along Central Avenue, west of Alameda Street, through the vineyards and orange orchards of William Wolfskill, Villalobo, Antonio Coronel, Henry Kohler, Ramon Valenzuela, Maria Antonio Villa de Reyes, Denison, Miller, and Waibel, as far as the orange orchards of W.T. Dalton at Washington Street (Lecouvreur 1869; Stevenson 1884; Layne 1957). It cannot be documented exactly when Zanja No. 3 was first dug, but it was probably between 1825 and 1831. As noted previously, from 1815 to 1825 Alameda Street was flooded by the Los Angeles River, so it is unlikely that a ditch would have been established along that location, or that the area would have been developed as agricultural land, prior to that date. In a court case adjudicated in 1869, Abel Stearns, a citizen of Los Angeles who had served as alcalde and member of the ayuntamiento in Mexican times, stated under oath that when he first arrived at the pueblo in December, 1831 Zanja No. 3 was already in existence, and since that time "has been continuously used by the citizens of Los Angeles for conveying water from the Los Angeles River through their fields and gardens" (Kohler vs. Los Angeles 1871).

There are fleeting references to Zanja No. 3 in the Mexican records for Los Angeles. In none of these documents was it called Zanja No. 3, since the numbering of the ditches did not occur until the early American period. It was reported to the ayuntamiento, on August 18, 1836, that the road to San Pedro (Alameda Street) was in bad condition because it was flooded by water from a zanja running through a surrounding orchard (City of Los Angeles, Archives, vol. 2:176). Since Zanja No. 3 ran through orchards on the west side of Alameda Street, it may have been the ditch to which that report referred. On March 28, 1846, Leonardo Cota petitioned the ayuntamiento that a bridge be built over the ditch on the land belonging to Mr. Pryor (City of Los Angeles, Archives, vol. 2:701). Since Nathaniel Pryor then owned land on the west side of Alameda between First and Aliso, it is more than likely that the ditch in question was Zanja No. 3.

In a deed given by David Alexander to Francis Mellus on October 6, 1853, conveying property at the southeast corner of Los Angeles and Aliso Streets, Zanja No. 3 is also mentioned. The description of the property reads that it lay "north of the

northern wall of the garden and vineyard which belonged to the late Nathaniel M. Pryor and between the street [Aliso] crossing the acequia [Zanja No. 3] going out towards the Aliso or house of Luis Vignes and the street running from the house of Benjamin D. Wilson towards San Pedro [Alameda]" (County of Los Angeles, Deed Record Book 1:386). This property, with the zanja, was illustrated by George Hansen in 1855 (Map 9).

There were also references to Zanja No. 3 in association with early attempts to construct a domestic water system in Los Angeles. In 1857 William Dryden and his Los Angeles Water Works Company was awarded the first domestic water supply contract for the city. In March, 1861 Dryden petitioned the City Council that the supply of water he was getting from the Avila Springs was not sufficient to meet local demands, and that he be allowed to put a water wheel in the zanja (Zanja No. 3) that ran by the alley (Marchessault Street) between the plaza and Alameda Street, in front of the Juan Sepulveda property, and divert water to his reservoir in the plaza. The Council did not object, as long as he did not interfer with the primary use of the zanja for irrigation purposes. In May, 1861 Dryden and the Los Angeles Water Works Company took Juan and Felipa Sepulveda to court and forced them to sell land they owned between the zanja and the plaza, because the corporation was "compelled in its progress to take possession of and use as its own" the Sepulveda lot "for the purpose of supplying the City of Los Angeles with pure fresh water." The property in question was described as "being the fractional part lying between the outer banks of the main zanja and branch zanja No. 3" (Los Angeles Water Works Company vs. Felipa and Juan Sepulveda 1861). The water works building Dryden put on the northwest corner of Marchassuelt and Alameda Streets, next to Zanja No. 3, was illustrated by both Lecouvreur (1874) and Koch (1871) (Maps 5, 10).

In February, 1865 the City signed a lease with David W. Alexander for the construction of another domestic water system. Alexander conveyed this franchise to Jean Louis Sainsevain in October, 1865. Sainsevain complained to the City Council that water was being diverted by the Los Angeles Water Works Company from the Zanja Madre into Zanja No. 3, where the company had a water wheel. The use of the zanja water by Dryden's company appeared to be in direct conflict with Sainsevain's contract with the City. The water committee of the City Council agreed with Sainsevain, and ordered the Los Angeles Water Company to halt the use of the water wheel in Zanja No. 3. The Council contended that Dryden's franchise only allowed him to bring water from his Avila Springs property and he was not entitled to water from the public zanjas (City of Los Angeles, Archives, vol. 6 and 7).

In July, 1869 there were complaints that the cleaning of Zanja No. 3 along Kohler and San Pedro Streets, along the west line of the Villa de Reyes property, had resulted in a pile of debris which interfered with traffic on these streets. The City Council was urged to move the zanja off the public road and onto the adjacent private property so that the streets could be properly opened (City of Los Angeles, Archives, vol. 7:91). Zanja No. 3 was administered as part of Water District No. 3, which also included Zanjas 1, 2, and 4, with deputy zanjero E.H. Dalton in charge of the District in 1881 (City of Los Angeles, City Council Minutes, vol. 14:560). In 1886 Dalton was appointed chief zanjero for the city (Layne 1957).

That portion of Zanja No. 3 below Aliso Street (between Los Angeles and Alameda Streets) flowed through lands that remained largely agricultural until after the Civil War. The principal crop appears to have been grapes, as several of the city's more productive vintners, including Manuel Requena, Nathaniel Pryor and Jean Luis Vignes, at various times owned property in and near this location. In 1868 however, Los Angeles began to consider the construction of its first railroad, connecting the city with its harbor. An election was held in March of that year, and the voters agreed to commit $150,000 in county bonds and $75,000 in city bonds to assist in the building of such a railroad. That same year the Los Angeles and San Pedro Railroad Company was organized, and construction began from Wilmington, a townsite at the harbor platted by Phineas Banning adjacent to San Pedro (Newmark 1930; Guinn 1915; Warner et al. 1876). The railroad at first intended to purchase the lot then owned by Mary Madigan on the southwest corner of Aliso and Alameda Streets for its terminus in Los Angeles. However, Mrs. Madegan's price of $14,000 was felt to be too high, so the company instead bought land from John G. Downey and James F. Burns, on the west side of Alameda Street south of the Madegan property, for $10,000 (Los Angeles Star, 2 July 1869).

With the railroad station planned for the Downey and Burns property, it became imperative that Commercial Street be extended east from Los Angeles Street to Alameda Street to allow access to the depot from the heart of the business district. As early as 1857 the City Council had entertained a petition to open Commercial Street between Los Angeles and Alameda Streets. This was never acted upon, however, probably because of the resistance of the property owners there, who were still operating vineyards on the land. On June 1, 1869 the City Council employed the surveyor Frank Lecouvreur to make a map for the extension of Commercial Street. Earlier that year, on March 15, 1869, Lecouvreur had completed a survey of the subdivision of the Los Angeles and San Pedro Railroad depot tract, on instructions from

John King and Wallace Woodworth. The City Council, on July 8, 1869, accepted this plan (Map 6) as the official map for both the railroad depot and the opening of Commercial Street (City of Los Angeles, City Council Minutes, vol. 6:351, 354).

In March 1869, a local newspaper noted that the saddle and harness store operated by H. Heinsch on the east side of Los Angeles Street was being demolished to make way for the extension of Commercial Street to Alameda Street (Wilson 1959:109). Herman Heinsch, a native of Prussia, had emigrated to Los Angeles in 1857 (Newmark 1930:231). In February, 1868 he had acquired, for $5,000 from Alexander Bell, property which had formerly been part of the Bell Block (County of Los Angeles, Deed Record Book 9:278). On April 15, 1869 Heinsch gave the City of Los Angeles a quit claim for the land necessary to open Commercial Street through his property (City of Los Angeles, City Council Minutes, vol. 6:325). Heinsch then built a new two story brick building on the northeast corner of Los Angeles and Commercial Streets and subdivided a tract of land on the north side of Commercial, east of his new store.

John G. Downey gave the City a deed for a right-of-way for Commercial Street through his property on April 22, 1869. One of the other property owners on the east side of Los Angeles Street, John Schumacher, was reluctant to sell a piece of his lot for the extension of Commercial Street, so the City had to initiate condemnation proceedings against him in May, 1869. On July 15, 1869 the City Council drafted an ordinance which declared Commercial Street between Los Angeles and Alameda Streets a public thoroughfare (City of Los Angeles, City Council Minutes, vol. 6:328, 335, 356).

In August, 1869 work on the railroad depot at the southwest corner of Alameda and Commercial Streets was progressing (Los Angeles Star, 21 August 1869). By the end of October that year the 23 miles of line between Los Angeles and Wilmington were finished, and the railroad commenced operations.

In the course of opening Commercial Street between Los Angeles and Alameda Street in 1869 the Los Angles City Council decided that a culvert or bridge should be built over Zanja No. 3 so that traffic in Commercial Street to the railroad depot would not be obstructed by the ditch. On April 22, 1869 the following notice appeared in the City Council Minutes:

> Resolved by the Council that a bridge be built over Zanja No. 3 in the extension of Commercial Street, the entire width of said street with a span of four feet,

> good and substantial brick masonry, at the rate of $90 for 24 feet, and that said work be done immediately; and that, at the same time the sidewalks on both sides of said street be constructed in connection with said bridge (City of Los Angeles, City Council Minutes, vol. 6:329).

The work was probably supervised by J.J. Warner, who has been appointed Street Commissioner for the City of Los Angeles on April 10, 1869. On May 22, 1869 Warner reported to the City Council that he had spent $199.16 for materials for street widenings, bridges and flumes, and for the hiring of laborers (City of Los Angeles, City Council Minutes, vol. 6).

At this same time, some of the first public sewers for Los Angeles were being constructed by the City along several of its major streets. In July, 1869 Herman Heinsch complained that the sewer at the intersection of Los Angeles and Commercial Streets was injurious to the new brick building he was putting up at this location. Heinsch filed a suit to remove this nuisance, prompting the City Council to hire the surveyor Frank Lecouvreur to study the problem and develop a solution. Lecouvreur's plan suggested that a new sewer system be constructed from the plaza along Los Angeles and Commercial Streets, connecting with Zanja No. 5. The City Council decided that the Commercial Street sewer should be built first. This sewer was planned to go under the Zanja Madre in Commercial Street near the Heinsch Block, and extend about 300 feet to the east to meet with Zanja No. 3 (City of Los Angeles, City Council Minutes, vol. 6:357-367). On August 19, 1869 proposals for the construction of the Commercial Street sewer were solicted by the City Council.

Two bids for the were received for the Commercial Street sewer, and on August 27, 1869 the City Council awarded the project to Wallace Woodworth, who was the low bidder at $3,945.34 (City of Los Angeles, City Council Minutes, vol. 6:369-370). Woodworth finished this work by October 28, 1869. On that day the City Council passed an ordinance which declared that the sewer constructed by Woodworth extending from Los Angeles Street through Commercial Street to Zanja No. 3 be considered a public sewer, and that Zanja No. 3, from the point where the new sewer emptied into it, now be considered a public sewer as well (City of Los Angeles, City Council Minutes, vol. 7:19). A city engineering drawing dated March 30, 1880 (Map 11) clearly illustrated that the sewer in the middle of Commercial Street, running east from Los Angeles Street under the brick conduit of the Zanja Madre to Zanja No. 3, was constructed of wood. There was also a water pipe shown running parallel to the sewer, under the Zanja Madre, on the south side of Commercial Street.

The vitality of Los Angeles, suggested by these developments of 1869, was appropriately captured by a local newspaper that September:

> Our streets just now present a scene of busy industry, a large body of workmen being engaged in laying the pipes for the city water company; the sewer on Commercial Street engages another body of men, while on Alameda Street, a small army of men are employed on the railway, on the depot, on the new houses in course of erection; which, with arrivals and departure of the railway trains, the turning around of carriages, omnibuses and hacks, give certain indication that we have at last waked up from our lethargy, and are making efforts to keep up with the progress of events around us (Los Angeles Star, 11 September 1869).

With the construction of the Commercial Street sewer, it was noticed that the months-old culvert over Zanja No. 3 was in a poor state of repair, and should be rebuilt. On October 14, 1869, Frank Lecouvreur presented a report to the City Council which suggested that in conjunction with finishing the Commercial Street sewer, the culvert over Zanja No. 3 should be enlarged, and the zanja itself should be widened for some distance downstream. As Lecouvreur told the Council: "The rebuilding of the culvert in question is a matter of unavoidable necessity, it being at present of barely sufficient size to admit the passage of water which Zanja No. 3 ordinarily carries and no more" (City of Los Angeles, Archives, vol. 7:107; City Council Minutes, vol. 7:14). Whether this recommendation was actually carried out, however, has not been determined.

It was the long range plan of the City Council to have the sewage in Zanja No. 3 carried to the Los Angeles River by way of an extension cut through private property. However, before this could be accomplished, citizens downstream from where the sewer emptied into the zanja began to complain that the water was now injuring their vineyards. In September, 1869 Henry Kohler filed suit against the City of Los Angeles. Henry Kohler had come to Los Angeles in 1854, and in partnership with another German emigrant named Frohling, he established a vineyard on Kohler Street between modern Seventh and Eighth Streets. Kohler and Frohling soon emerged as two of the most important wine makers in Los Angeles, being the first to ship large quantities to San Francisco (Wilson 1959:65). Kohler's complaint against the City alleged that the sewer from Commercial Street contaminated Zanja

No. 3, making its waters unfit for irrigation or domestic purposes for the 18 downstream users of the zanja. The City contended that the zanja was not meant for domestic use, as two private water companies could supply household water for a fee; that for many years people upstream from Kohler had been dumping their waste into Zanja No. 3; that the sewage was not injurious to irrigation since it contained fertilizing substances; and "there are no other adequate means of sewage, but through the different acequida of the city." The judgement, given on May 24, 1870, was in Kohler's favor, with the court ordering the sewer into Zanja No. 3 disconnected, and awarding Kohler $47.21 to cover court costs and damages. The City appealed, but the State Supreme Court upheld the lower court's opinion. With the execution of the order, on July 15, 1871, the county sheriff cut off the Commercial Street sewer, and impounded a City-owned horse and cart until the award was paid (Kohler vs Los Angeles 1871).

With the shutting off of the sewer into Zanja No. 3, the City Council decided, in April, 1871, to have a cesspool built on Wilmington Street into which the Commercial Street sewer could be emptied (City of Los Angeles, City Council Minutes, vol. 7:305-308). In October of that year, Manuel Requena filed suit against the City, claiming that the cesspool on Wilmington damaged his property. The court found against Requena, and the City settled the matter by paying him $200. The City Council then solved the sewer problem, in June, 1872, by extending the sewer down Los Angeles Street and building a new ditch, called Zanja No. 9, specifically to carry sewage from Zanja No. 5 on First Street to Olive Street (City of Los Angeles, City Council Minutes, vol. 7).

In February, 1881 the landowners on Commercial Street, between Los Angeles and Alameda Streets, petitioned the City Council for a new sewer to connect the old Commercial Street sewer from Zanja No. 3 to the Alameda Street sewer. It was found that the old Commercial Street sewer could not be used because it was above the grade of the Zanja Madre on Commercial Street, so it was recommended that a totally new sewer be constructed. On April 30, 1881 the City Council resolved that a new Commercial Street sewer should be built as a main branch of the public sewer system, connecting the cesspool on Wilmington Street with the sewer on Alameda Street. According to the Council Minutes, "the said sewer to be either of cement pipe, or of glazed burnt clay pipe, or of brick, and to be eight inches in diameter." The cost of the sewer was not to exceed $1 per foot, and was to be paid for by an assessment raised from property owners along the portion of Commercial Street serviced by the new sewer. Bids for the

new sewer line were received on June 11, 1881 and on June 18, 1881 the City Council selected Thomas Copley (listed in the 1875 city directory as a cart contractor and grader) as the low bidder. Copley proposed that a clay pipe be used to cross Zanja No. 3, but that the rest of the sewer be an eight-inch cement pipe (City of Los Angeles, City Council Minutes, vol. 14; Oliver and Armor 1875). With the construction of the new Commercial Street sewer in July 1881, the Wilmington Street cesspool was cut off and filled in, and the old sewer between the Zanja Madre and Zanja No. 3 was cleaned out. Copley laid his new sewer line down the middle of the older wooden sewer, extending it east through Zanja No. 3 to Alameda Street.

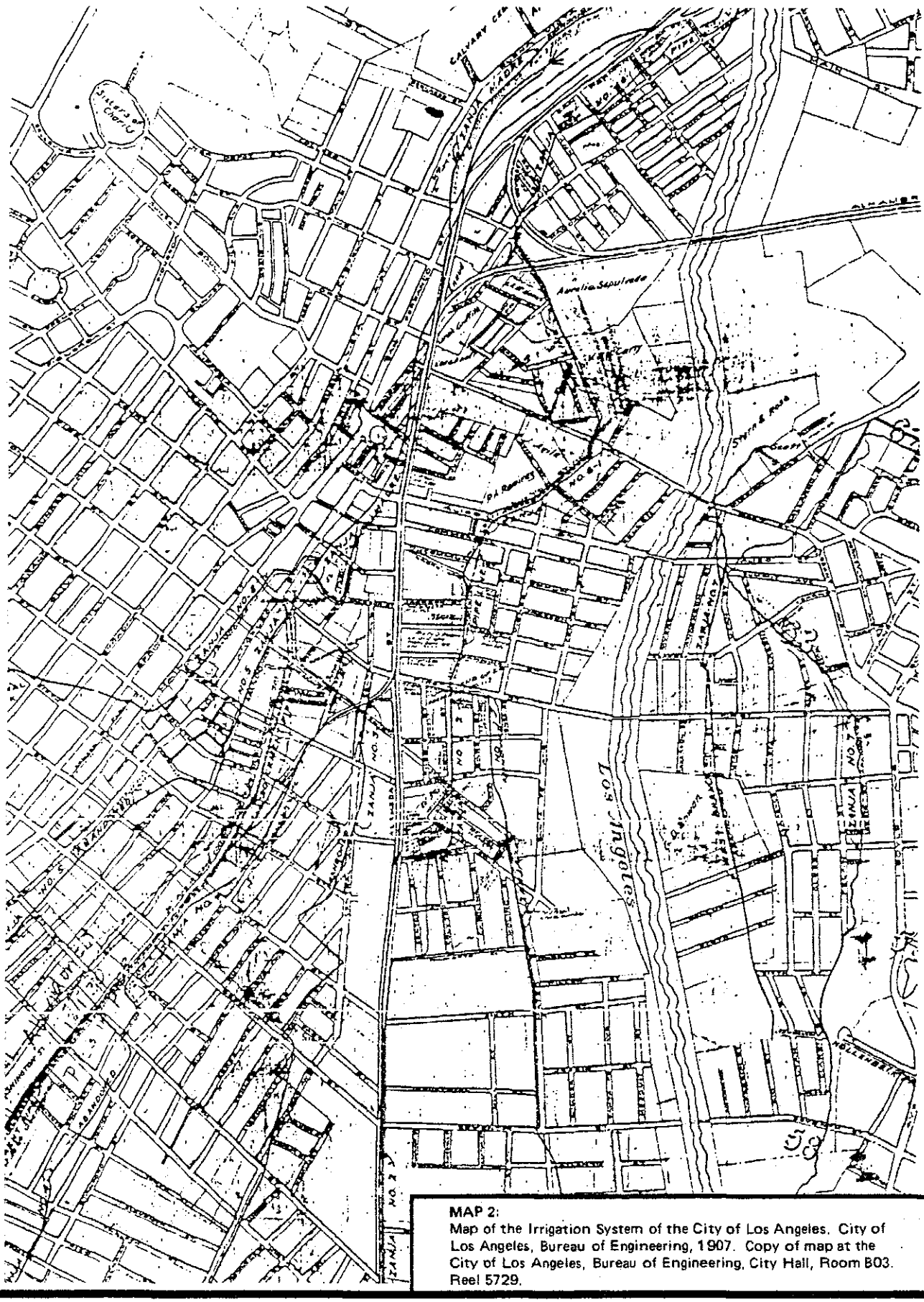
With commercial development, the need for an irrigation ditch between the plaza and First Street declined. What had been vineyards in the early 1860s evolved into an important business section of the city by the early 1870s, with hotels, restaurants, offices, houses, a lumber yard, and railroad depot. Zanja No. 3 was soon being discussed as a nuisance, causing damage to adjacent property when it flooded. For example, in February, 1870 the railroad depot was flooded when water overspilled the ditch. The City Council was asked in July, 1870 to employ a chain gang to fill in the east side of the railroad tracks on Alameda Street to protect against future overflows of Zanja No. 3 (Los Angeles Star, 5 February 1870, 2 July 1870). In November, 1875 Mary Madegan petitioned the City Council to flume Zanja No. 3 where it passed through her property on the southwest corner of Aliso and Alameda Streets, because the ditch was frequently flooding the livery on her land (City of Los Angeles, City Council Minutes, vol. 10:180). Several property owners on Vine Street (which later became Central Avenue between Jackson and First Streets) complained to the City Council in January, 1879 that they felt that the open ditch of Zanja No. 3 running through the middle of the street was dangerous and a nuisance. In March, 1879 it was suggested that Zanja No. 3 be converted into a pipe or flume from J.M. Griffith's lumber yard on Jackson Street to the Wolfskill property on Alameda Street south of First Street (City of Los Angeles, City Council Minutes, vol. 12:677, 795). It was reported to the Council in March, 1881 that when the Vine Street sewer was installed Zanja No. 3 broke from its banks, "the ditch being very old and decayed" (City of Los Angeles, City Council Minutes, vol. 14:577).

On September 30, 1882 the Committee on Zanjas recommended to the City Council that Zanja No. 3 should be abandoned from its place of origin on the Zanja Madre, near the modern intersection of Los Angeles and Alameda Streets, south to First Street. Water was then to be conveyed down the Zanja Madre to First Street, and then distributed to Zanja No. 3 south of that point. The Council

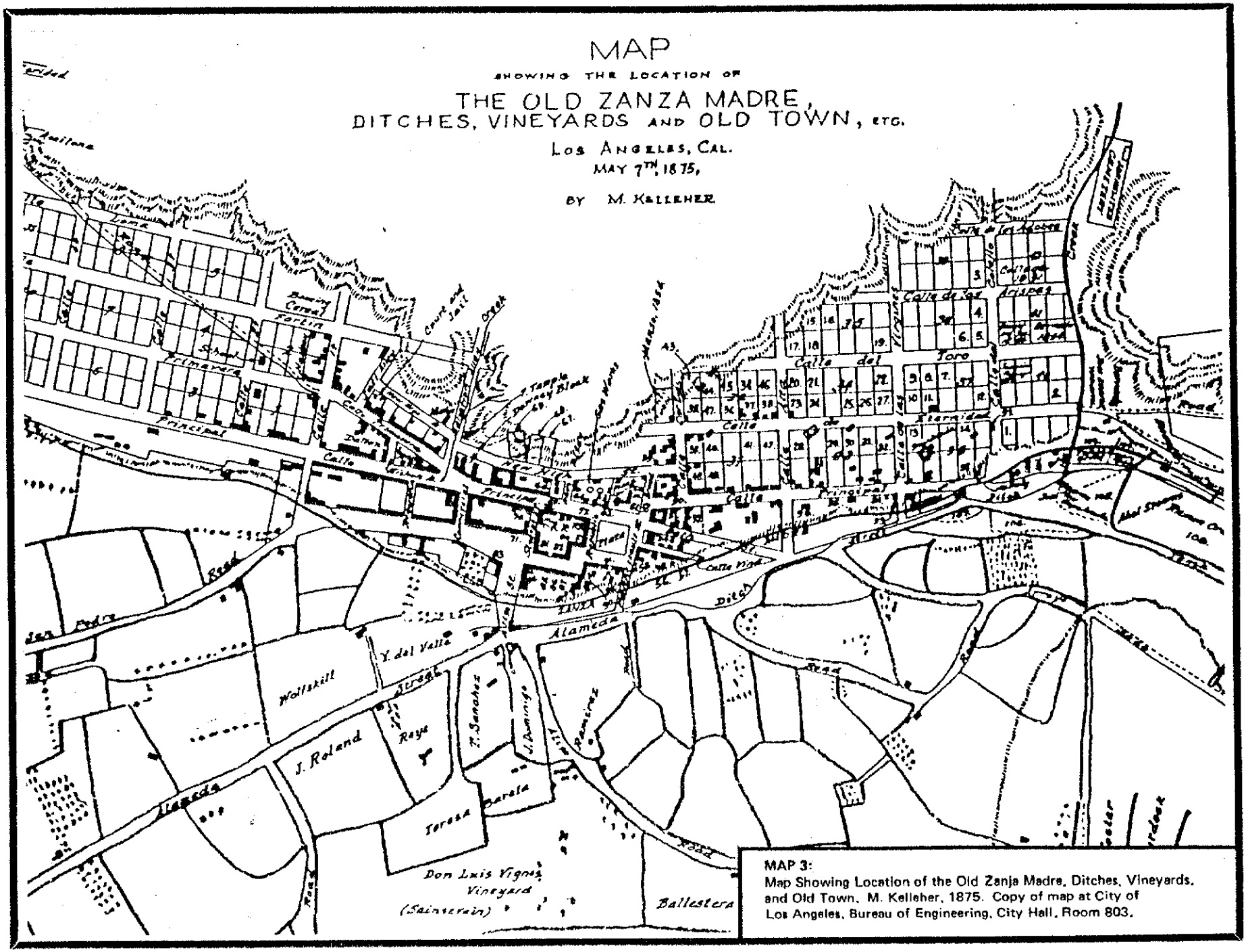
acted on this report, and in November, 1882 specifications were drawn up to continue the brick conduit of the Zanja Madre from Requena Street to First Street, and bids for the work were advertised (City of Los Angeles, City Council Minutes, vol. 15:613, 672). On March 19, 1883 the City entered into a contract with E.H. Hamilton and W.A. Frick to connect the Zanja Madre on First Street with 700 feet of 30-inch pipe to Zanja No. 4 at San Pedro Street, and with 481 feet of 22-inch pipe to Zanja No. 3 at Vine Street. The pipeline to Zanja No. 4 was to cost $1.85 per foot, while the pipeline to Zanja No. 3 cost $0.90 per foot. This work was completed by May 19, 1883 (City of Los Angeles, City Council Minutes, vol. 16:149, 296). In December, 1883 city health officials recommended that the abandoned ditch of Zanja No. 3 between Jackson and First Streets be filled in, as it constituted a nuisance (City of Los Angeles, City Council Minutes, vol. 17:242). It was, therefore, in the period from November, 1882 to March, 1883 that Zanja No. 3 between Aliso and Temple Streets, including the section beneath commercial street was abandoned. The ditch in this area was probably filled in by the end of 1883.

Even after this date, Zanja No. 3 south of First Street continued in use. It was shown on various city engineering drawings. For example, an 1888 drawing by J.H. Dockweiler, City Surveyor, illustrated well and pipe structures on Zanja No. 3 an No. 4 at First and San Pedro Streets (Dockweiler 1888). Hall (1888) stated that by 1888 Zanja No. 3 was an open ditch from First to Seventh Street, and a 22-inch pipe from Seventh to Twelfth between Third and Eighth Streets, but did not indicate what it was made of (Eaton 1890). In 1894 J.H. Dockweiler drew a profile of Zanja No. 3, showing it in Central Avenue from Fourth to Seventh Street. By that time the zanja in this section had been converted tc a 22-inch cement pipe. As with the rest of the zanja system, Zanja No. 3 was probably abandoned around the turn of the century. The 22-inch cement pipe, which extended at least from Fourth to Tweleth Street, was later utilized as a storm drain before being put out of commission. As late as 1943, however, the City Department of Public Works considered rehabilitating the section under Central Avenue between Third and Seventh Streets for use again as a storm drain, but the old zanja was found to be in poor condition, and was cut by utilities, and could therefore not be reused.

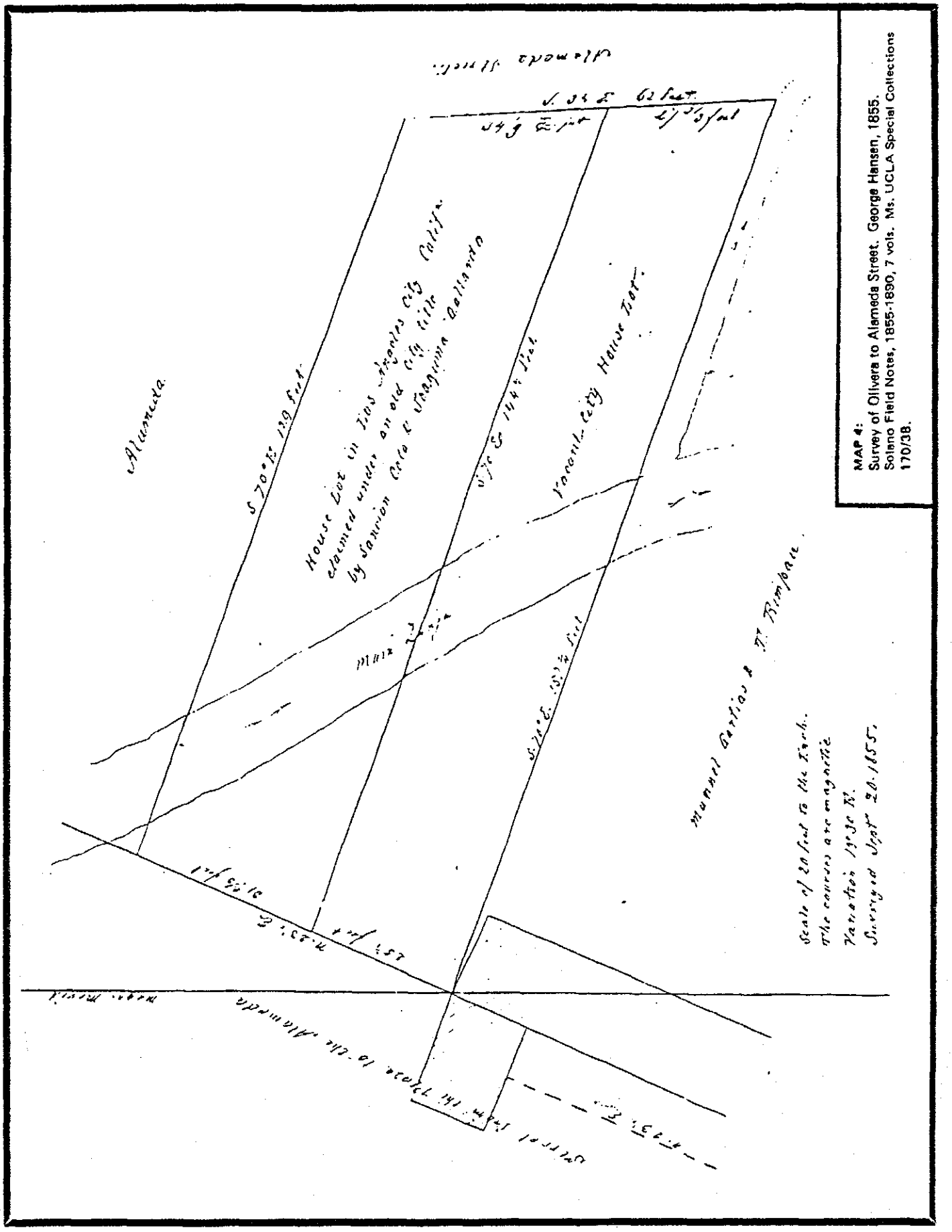
MAP 1:
Plan de la Cuidad de Los Angeles. E.O.D, ORD, 1849.
Copy of map at City of Los Angeles, Bureau of
Engineering, City Hall, Room 803. HS No. 270.



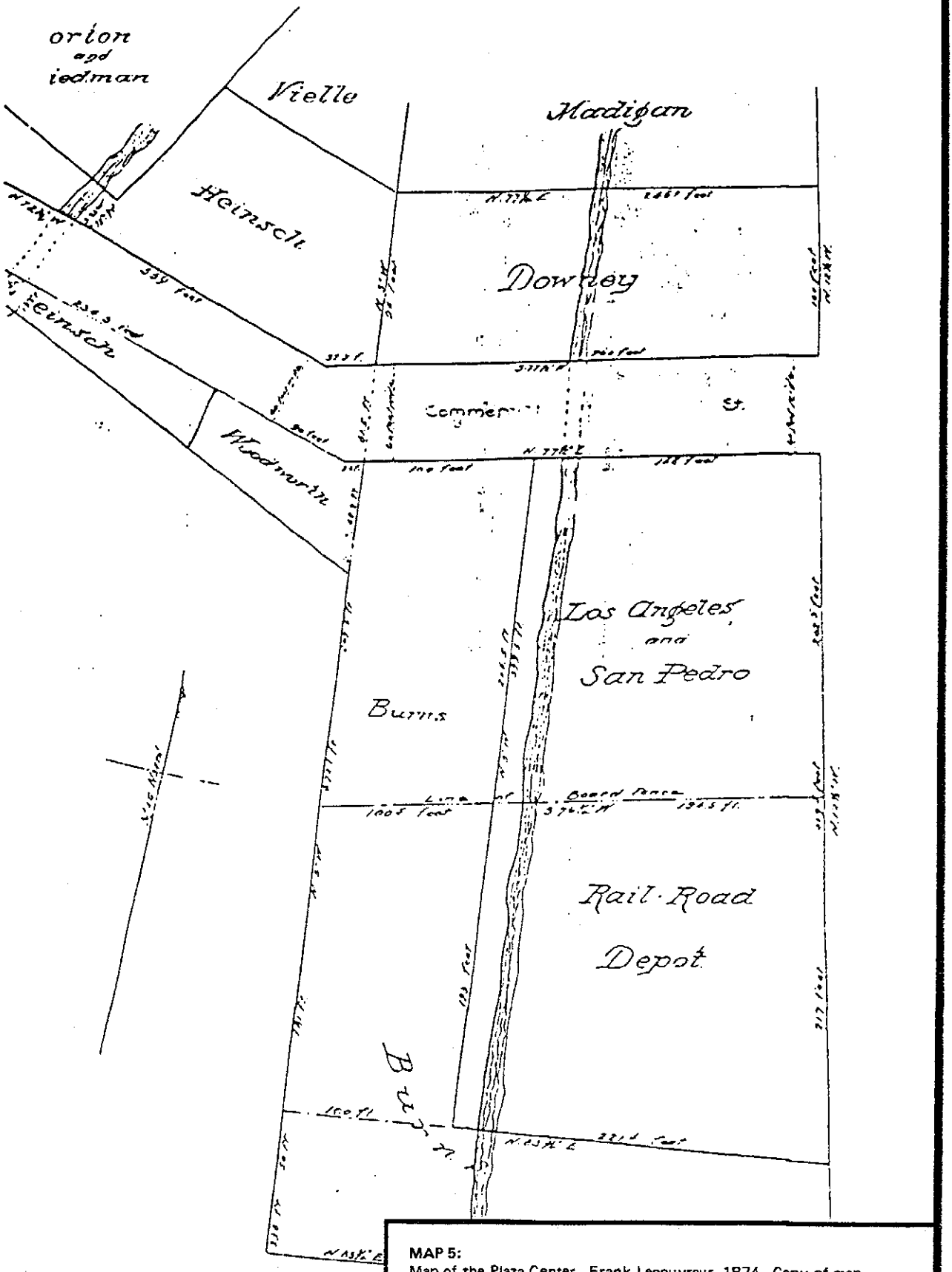
MAP 2:
Map of the Irrigation System of the City of Los Angeles. City of Los Angeles, Bureau of Engineering, 1907. Copy of map at the City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Reel 5729.



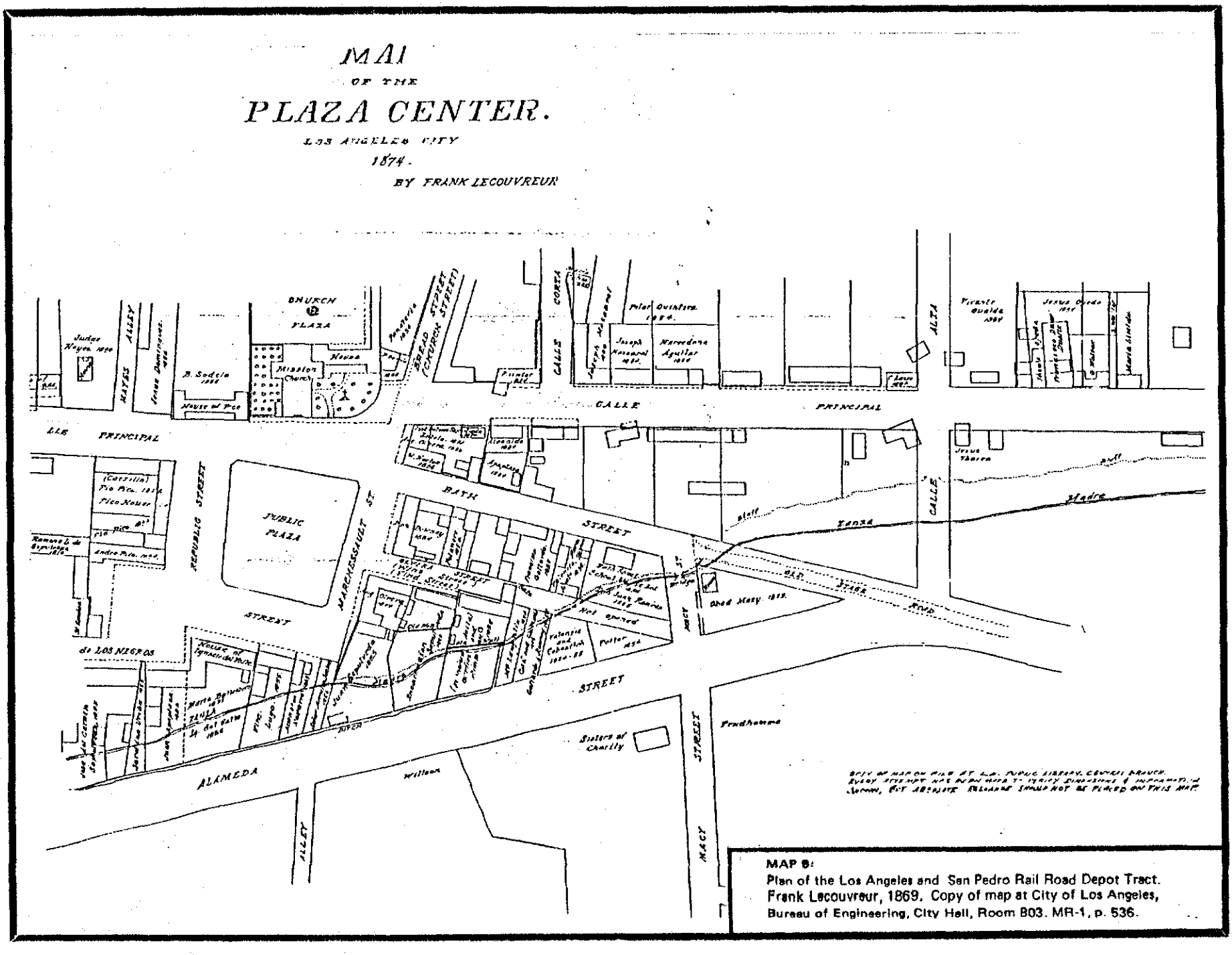
MAP 3:
Map Showing Location of the Old Zanja Madre, Ditches, Vineyards, and Old Town. M. Kelleher, 1875. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803.



MAP 4:
Survey of Olivera to Alameda Street. George Hansen, 1855.
Solano Field Notes, 1855-1890, 7 vols. Ms. UCLA Special Collections 170/38.

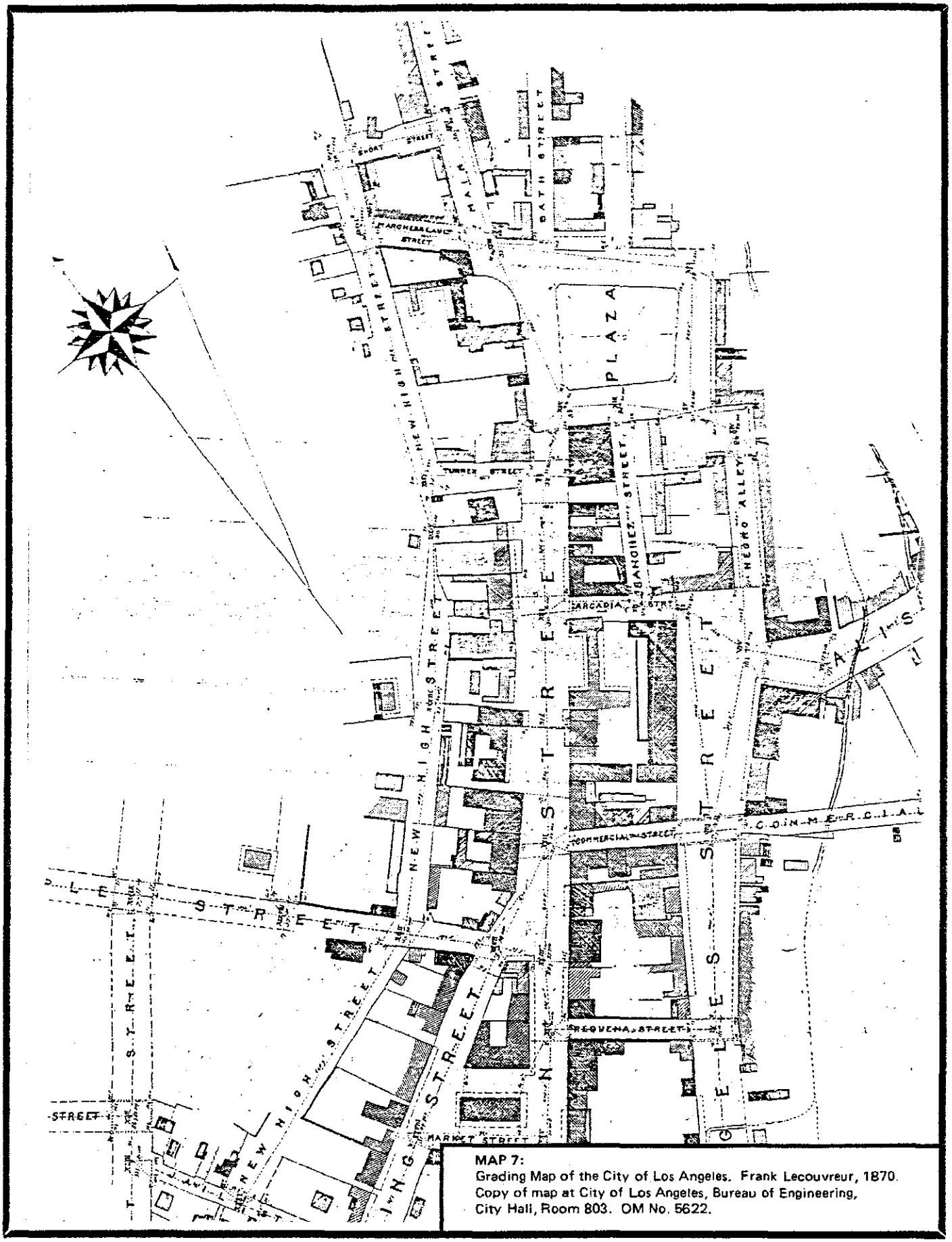


MAP 5:
Map of the Plaza Center. Frank Lecouvreur, 1874. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803.

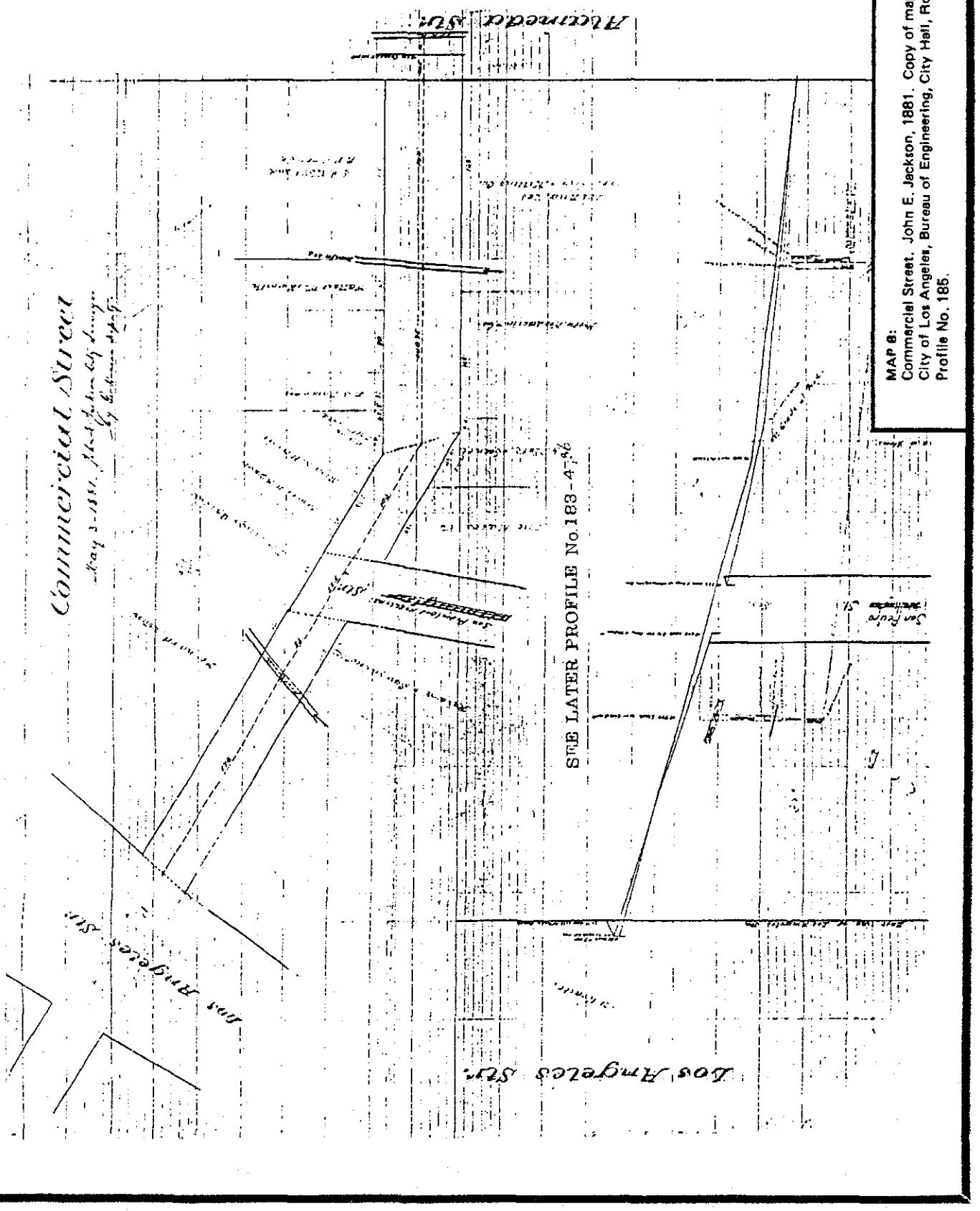


COPY OF MAP ON FILE AT L.A. PUBLIC LIBRARY, CENTRAL BRANCH.
EVERY EFFORT HAS BEEN MADE TO VERIFY DIMENSIONS & INFORMATION
SHOWN, BUT ABSOLUTE ACCURACY SHOULD NOT BE PLACED ON THIS MAP.

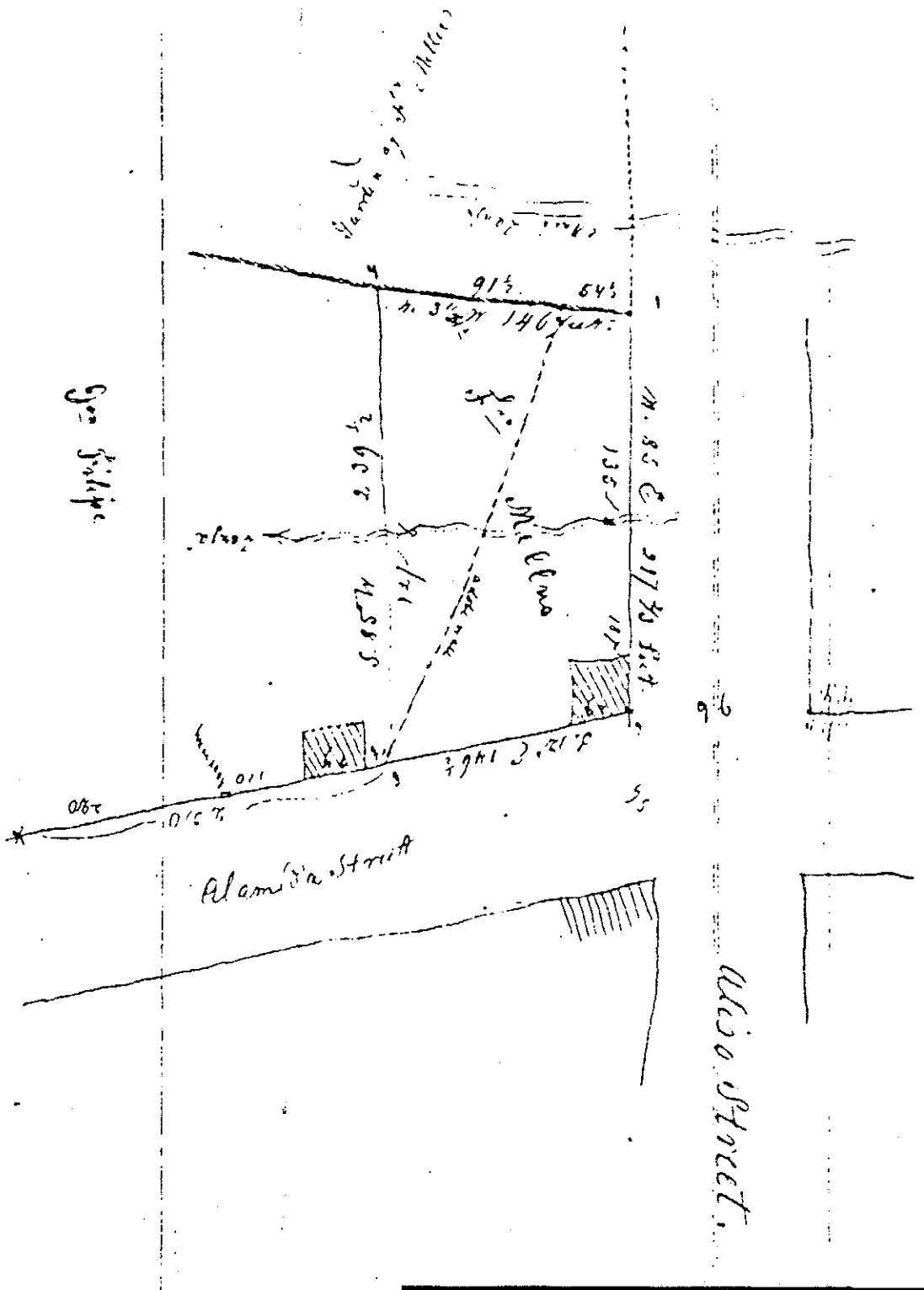
MAP 8:
Plan of the Los Angeles and San Pedro Rail Road Depot Tract.
Frank Lecouvreur, 1869. Copy of map at City of Los Angeles,
Bureau of Engineering, City Hall, Room 803. MR-1, p. 536.



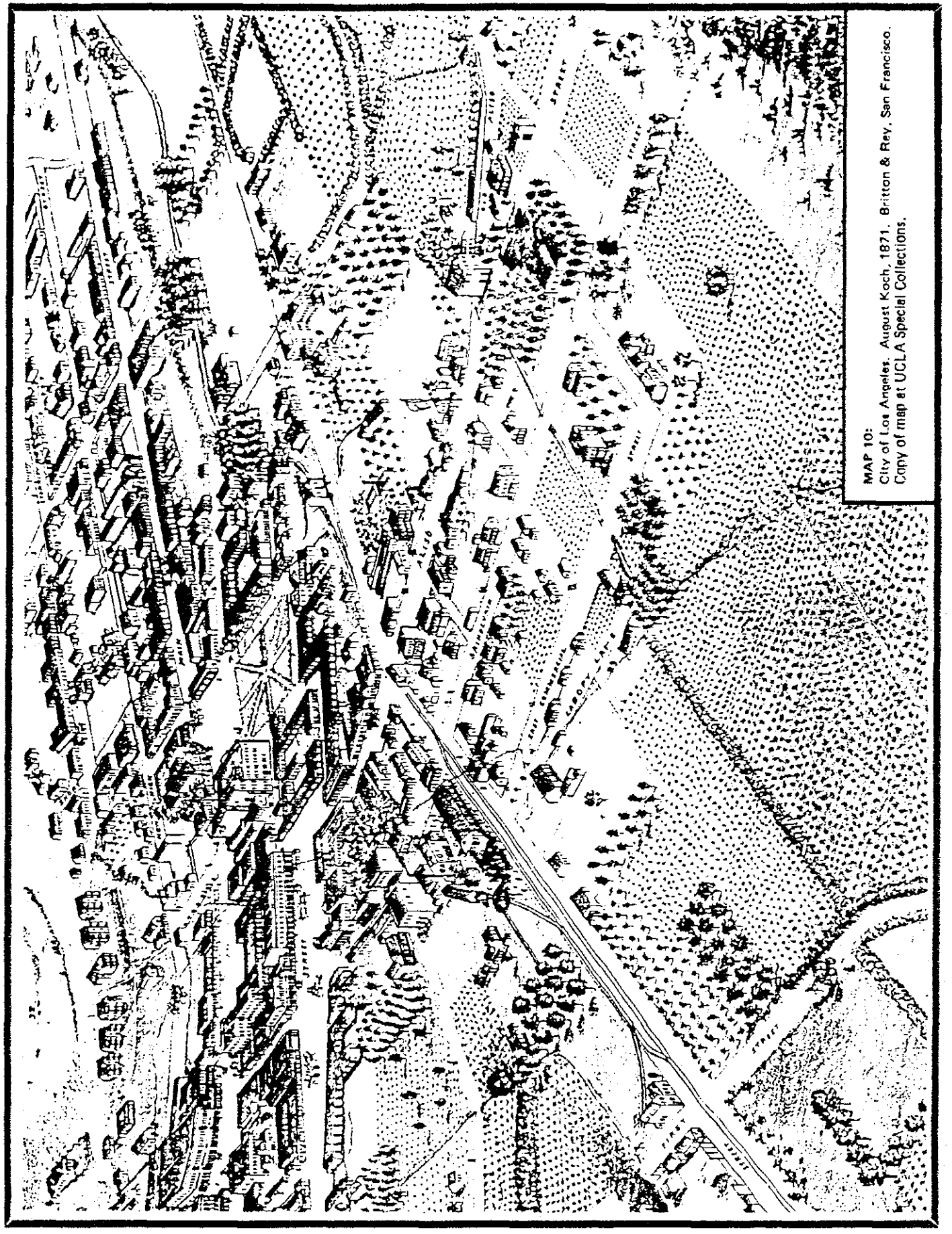
MAP 7:
Grading Map of the City of Los Angeles. Frank Lecouvreur, 1870.
Copy of map at City of Los Angeles, Bureau of Engineering,
City Hall, Room 803. OM No. 5622.



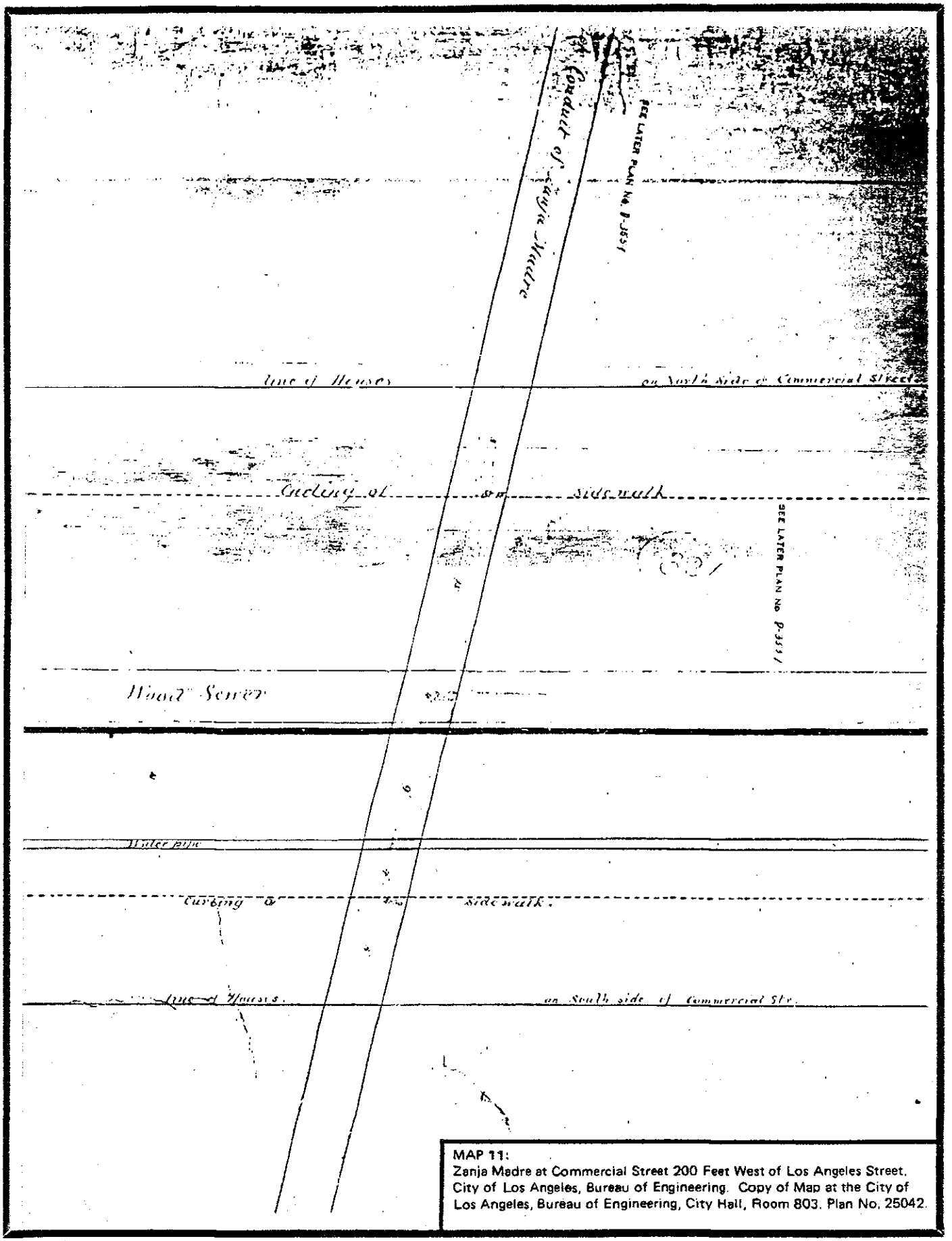
MAP 8:
Commercial Street. John E. Jackson, 1881. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Profile No. 185.



MAP 9:
Survey of the House Lot of F. Mellus. George Hansen, 1855.
In Hansen and Solano Field Notes, 1855-1890, 7 vols. Ms. UCLA Special Collections 170/38.



MAP 10:
City of Los Angeles. August Koch, 1871. Britton & Rey, San Francisco.
Copy of map at UCLA Special Collections.



MAP 11:
Zanja Madre at Commercial Street 200 Feet West of Los Angeles Street. City of Los Angeles, Bureau of Engineering. Copy of Map at the City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Plan No. 25042.

BIBLIOGRAPHY AND REFERENCES CITED

Anonymous
1894 The City and County of Los Angeles Commercial and Manufacturing Interests Representing Business Enterprises and Professional Men. Press of Times-Mirror Printing and Binding House, Los Angeles.

Bancroft, H.H.
1884 History of California, vol. 1. The History Company, San Francisco.

Bell, Horace
1927 Reminiscences of a Ranger. Wallace Hebberd, Santa Barbara.

Brooks, Thomas
1938 Notes on Los Angeles Water Supply. City of Los Angeles, Water Bureau, Los Angeles.

Burrows, Henry D.
1893 Capt. Alexander Bell and the Bell Block. Ms. on file at the Seaver Center for Western Historical Research, County of Los Angeles Museum of Natural History.

Bynum, Lindley
1931 Governor Don Felipe de Neve. Annual Publications of the Historical Society of Southern California 15.

Caughey, John
1976 The Country Town of the City of the Angels. In Los Angeles: Biography of a City, edited by John and LaRee Caughey, pp.73-78. University of California Press, Berkeley.

Chartkoff, Joseph and Kerry Charkoff
1972 Archaeological Research Potential in Urban Los Angeles. Pacific Coast Archaeological Society Quarterly 8(2):57-66.

City of Los Angeles
n.d. Archives. Ms. at the City of Los Angeles Archives and Records Center, Piper Technical Center, Los Angeles.

n.d. City Council Minutes. Ms. at the City of Los Angeles Archives and Records Center, Piper Technical Center, Los Angeles.

City of Los Angeles, Bureau of Engineering
1880a Profile of the Zanja Madre. Copy of map at the City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Profile #10255.

1880b Zanja Madre at Commercial Street 200 Feet West of Los Angeles Street. Copy of map at the City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Plan #25042.

1883 Map of Wilmington & Jackson St. Sewer and New Alameda St. Sewer. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. OM #9089.

1907 Map of the Irrigation System of the City of Los Angeles. Copy of map at the City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Reel 5729.

Cleland, Robert Glass
1941 The Cattle on a Thousand Hills: Southern California, 1850-1870. The Huntington Library, San Marino.

Costello, Julia G. and Larry R. Wilcoxon
1978 An Archaeological Assessment of Cultural Resources in Urban Los Angeles. City of Los Angeles, Department of Public Works, Los Angeles.

Corran, W.H.L.
1887 Los Angeles City Directory. W.H.L. Corran, Los Angeles.

County of Los Angeles
n.d. Archives of the Prefecture of the County of Los Angeles. Ms. at City of Los Angeles Archives and Records Center, Piper Technical Center, Los Angeles.

n.d. Deed Record Books. Ms. at County of Los Angeles, Hall of Records.

Dockweiler, J.H.
1888 L.A.C.Ry. Well & Pipe for Zanja 3 & 4 at First & San Pedro Sts. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Plan #25087.

1894 Profile of Zanja No. 3 From Fourth to Seventh Streets. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Profile #11231.

Dumke, Glenn S.
1944 The Boom of the Eighties in Southern California. Huntington Library, San Marino.

Eaton, Fred
1890 Map of Zanja No. 3 Between 3rd and 8th Sts. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Map #2228.

Ferguson, Al
1972 The Zanja System-Mother of Storm Drains and Water Distribution. The Data Sheet A Publication for Employees of the City of Los Angeles, Bureau of Engineering 4:2.

Fogelson, Robert M.
1967 The Fragmented Metropolis: Los Angeles, 1850-1930. Harvard University Press, Cambridge.

Friedman, Paul D. and Beth Padon
1986 GSA Los Angeles Federal Building Project Preliminary Letter Report. LSA, Newport Beach. Submitted to General Services Administration, San Francisco.

Goldworthy, John
1879 Profile of Zanja Madre. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Profile #10271.

Guinn, J.M
1915 A History of California and an Extended History of Los Angeles and Environs. Historical Record Company, Los Angeles.

Hall, William H.
1888 Irrigation in California (Southern), the Second Part of the Report of the State Engineer of California on Irrigation and the Irrigation Question. California State Printing Office, Sacramento.

Hansen, George
1855a Survey of the House Lot of F. Mellus. In Hansen and Solano Field Notes, 1855-1890, 7 vols. Ms. UCLA Special Collections 170/38.

1855b Survey of Olivera to Alameda Street. In Hansen and Solano Field Notes, 1855-1890, 7 vols. Ms. UCLA Special Collections 170/38.

1869 Map of Alameda Street From Aliso St. to the City Limits. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. City Clerk's Map Book 2, p. 61.

1883 First Street Zanjas 5,4, & 3. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Profile #11092.

Huey, Gene, Rodger Cook and Lois Webb
1980 Archaeological Survey Report for the El Monte Busway Extension in the City of Los Angeles, Los Angeles County, California. Caltrans District 07, Los Angeles.

Jackson, John E.
1881 Commercial Street. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Profile #185.

Jessup, J.J.
1933 Storm Drains in Commercial Street Between San Pedro Street and Main Street. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Plan #D-3559.

Johnson, Bernice
1962 California's Gabrielino Indians. Frederick Webb Hodge Anniversary Publication Fund Volume 8. Southwest Museum, Los Angeles.

Jore, Leonce
1963 Jean Louis Vignes of Bordeau, Pioneer in California Agriculture. Southern California Quarterly 45(4):289-303.

Kelleher, M.
1875 Map Showing Location of the Old Zanja Madre, Ditches, Vineyards, and Old Town. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803.

Kirker, Harold
1973 California's Architectural Frontier: Style and Tradition in the Nineteenth Century. Peregrine Smith, Santa Barbara.

Koch, August
1871 City of Los Angeles. Britton & Rey, San Francsico. Copy of map at UCLA Special Collections.

Kohler, H. vs. City of Los Angeles
1871 District Court Case #1523. Ms. at County of Los Angeles, Archives, Hall of Records.

Kramer, William, and Norton B. Stern
1985 Isaac Lankershim of the San Fernando Valley: Jewish Born Baptist. Southern California Quarterly 68(1):25-34.

Layne, Gregg
1935 Annals of Los Angeles. California Historical Society, San Francisco.

1957 Water and Power for a Great City. City of Los Angeles, Department of Water and Power, Los Angeles.

Leary, A.J.
1884 Los Angeles City and County Directory. Southern California Publishing Company, San Francisco.

Lecouvreur, Frank
1869a Plan of the Los Angeles and San Pedro Rail Road Depot Tract. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. MR-1, p. 535.

1869b Plan of Kohler Street. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. HS #2071.

1870 Grading Map of the City of Los Angeles. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. OM #5622.

1874 Map of the Plaza Center. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803.

Los Angeles Star

Los Angeles Water Works Company vs. Felipa and Juan Sepulveda
1861 District Court Case #811. County of Los Angeles, Archives, Hall of Records.

Loyer, Fernand and Charles Beaudreay
1932 Le Guide Francais de Los Angeles et du Sud de la California. Franco-American Publishing Company, Los Angeles.

McPherson, William (ed.)
1873 Charter and Revised Ordinances of the City of Los Angeles. Los Angeles Star Printing, Los Angeles.

Mesmer, Louis
1904 Soil Survey of the Los Angeles Area, California. Bureau of Soils, U.S. Department of Agriculture, Washington, D.C.

Moore, W.
1874 Plan of Alameda Street. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. OM #11.

Moore and Kelleher
1875a Subdivision of Property of Don Manuel Requena. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall. M.R. 3-147.

1875b Subdivision of the Pryor Tract. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall. M.R. 2-634.

Montgomery, W.F.
1942 Pioneer Lumber Dealers in Los Angeles. The Historical Society of Southern California Quarterly 24(2)66-68.

Nadeau, Remi
1948 City Makers. Doubleday and Company, Garden City.

Nelson, Howard J.
1977 The Two Pueblos of Los Angeles: Agricultural Village and Embryo Town. Southern California Quarterly 59(1):1-11

Nelson, J.W., C.J. Zinn, A.T. Strahorn, E.B. Watson, and J.E. Dunn
1919 Soils of the Los Angeles Area, California. Bureau of Soils, U.S. Department of Agriculture, Washington, D.C.

Newmark, Harris
1930 Sixty Years in Southern California. Houghton Miffin Company, Boston.

Newmark, Marco
1956 Historical Profile: Isaac Van Nuys. The Historical Society of Southern California Quarterly 38:91-93.

Newmark, Maurice, and Marco Newmark (eds.)
1929 Census of the City and County of Los Angeles, California for the Year 1850. The Times-Mirror Press, Los Angeles.

Oliver, J.A. and S. Armor
1875 Directory of the City of Los Angeles. Mirror Book and Job Printing House, Los Angeles.

Ord, E.O.D.
1849 Plan de la Cuidad de Los Angeles. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. HS #270.

Ostrom, Vincent
1953 Water and Politics: A Study of Water Policies and Administration in the Development of Los Angeles. The Haynes Foundation, Los Angeles.

Padon, Beth
1986a Veterans Administration Los Angeles Outpatient Clinic Archaeological Assessment Report Phase 2. LSA, Newport Beach. Submitted to U.S. Veterans Administration.

1986b General Services Administration, Federal Center Archaeological Assessment, Phase 2, Welton Becket Associates, Santa Monica, CA.

Padon, Beth, Rod Raschke, and Rodger Hatheway
1984 Cultural Resources Assessment of the Proposed Los Angeles Federal Center, Los Angeles, California.

Pryor, N. vs. Downey et al.
1873 District Court Case #1737. County of Los Angeles, Archives, Hall of Records.

Ritchie, Ward (ed.)
1963 The First Los Angeles County Directory, 1872. Ward Ritchie Press, Los Angeles.

Robinson, G.P.
1907 Zanja Madre. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. Plan #224

Robinson, W.W.
1966 Maps of Los Angeles, From Ord's Survey of 1849 to the end of the Boom of the Eighties. Dawson's Book Shop, Los Angeles.

Salvator, Ludwig Louis
1929 Los Angeles in the Sunny Seventies. Jake Zeitlin, Los Angeles.

Sanborn
1883-1887 Insurance Maps of Los Angeles. Sanborn Map and Publishing Company, New York. Copy at Los Angeles City Bureau of Engineering, City Hall, Room 803. HS#281.

Smith, Aaron
1878 Los Angeles City Directory. Mirror Printing, Los Angeles.

Stevenson, H.J.
1884 Map of the Irrigation System of the City of Los Angeles. Copy of map at City of Los Angeles, Bureau of Engineering, City Hall, Room 803. OM #5535.

Temple, Thomas Workman
1931 Se Foundaron un Pueblo de Espanoles. Annual Publication of the Historical Society of Southern California 15.

Warner, J., B. Hayes, and J. Widney
1876 An Historical Sketch of Los Angeles County. Lewis Levin and Company, Los Angeles.

Wilson, John Albert
1959 Reproduction of Thompson and West's History of Los Angeles, California, 1880. Howell-North, Berkeley.

Workman, Boyle
1936 The City that Grew. The Southland Press, Los Angeles.